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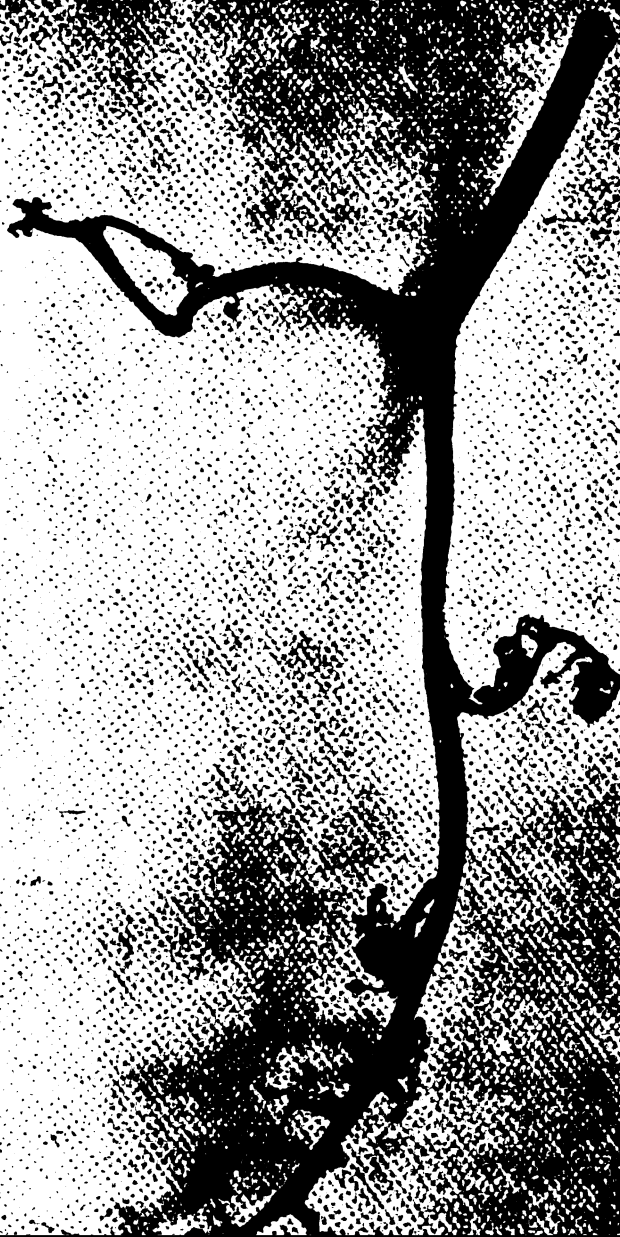
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*Annual report [with  
accompanying documents].*

New York (State). Dept. of Agriculture

Fig 3.

339  
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**JULY 11, 1916**

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**James Sturgis Pray,**  
**Cambridge, Mass.**







THIRTEENTH ANNUAL REPORT  
OF THE  
BOARD OF CONTROL  
OF THE  
NEW YORK  
Agricultural Experiment Station,  
(GENEVA, ONTARIO COUNTY.)  
FOR THE YEAR 1894,  
WITH REPORTS OF DIRECTOR AND OTHER OFFICERS.

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TRANSMITTED TO THE LEGISLATURE MARCH 7, 1895.

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1895.

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**Jul. 11, 1916**

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**Prof. John S. Pray.**



# STATE OF NEW YORK.

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No. 99.

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## IN ASSEMBLY,

MARCH 7, 1895.

---

### THIRTEENTH ANNUAL REPORT

OF THE

Board of Control of the New York Agricultural  
Experiment Station.

---

STATE OF NEW YORK :

DEPARTMENT OF AGRICULTURE, }  
ALBANY, *March 7, 1895.* }

*To the Assembly of the State of New York :*

I have the honor to herewith transmit the Thirteenth Annual Report of the Director and Board of Managers of the New York Agricultural Experiment Station at Geneva.

I am, respectfully,

FRED. C. SCHRAUB,

*Commissioner of Agriculture.*



1 8 9 4 .

## ORGANIZATION OF THE STATION.

---

### BOARD OF CONTROL.

ROSWELL P. FLOWER, <i>Governor</i> .. .. .	Albany.
W. C. BARRY, <i>President</i> .....	Rochester, Monroe County.
CHARLES JONES.....	Geneseo, Livingston County.
GEORGE F. MILLS.....	Fonda, Montgomery County.
PHILIP N. NICHOLAS .....	Geneva, Ontario County.
ADRIAN TUTTLE .....	Watkins, Schuyler County.
S. H. HAMMOND .....	Geneva, Ontario County.
WILLIAM D. BARNS .....	Middle Hope, Orange County.
MARTIN VAN BUREN IVES .....	Potsdam, St. Lawrence County.
LUMAN D. OLNEY .....	Watertown, Jefferson County.

---

### STATION OFFICERS.

Director .....	Dr. PETER COLLIER.
First Assistant .....	WM. P. WHEELER.
Horticulturist .....	S. A. BEACH, M. S.
Assistant Horticulturist.....	WENDELL PADDOCK, B. S.
Chemist.....	L. L. VAN SLYKE, Ph. D.
Assistant Chemist.....	C. G. JENTER, Ph. C.
Assistant Chemist.....	A. L. KNISELY, B. S.
Assistant Chemist.....	W. B. CADY, Ph. C.
Assistant Chemist.....	* A. D. COOK, Ph. C.
Assistant Chemist. ....	* H. H. SEELY, A. B.
Entomologist.....	† F. A. SIRRINE, M. S.
Entomologist.....	† VICTOR H. LOWE, B. S.
Agriculturist .....	GEORGE W. CHURCHILL.
Clerk and Stenographer .....	FRANK E. NEWTON.

Post-office address: Geneva, Ontario county, N. Y.

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\* Connected with Fertilizer Control

† Connected with Long Island Branch Station



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# THIRTEENTH ANNUAL REPORT

OF THE

## Board of Control of the New York State Agricultural Experiment Station.

### TREASURER'S REPORT.

GENEVA, N. Y., October 1, 1894.

*To the Board of Control of the New York Agricultural Experiment Station :*

The treasurer of the Board of Control respectfully submits the following report for the year ending September 30, 1894 :

WILLIAM O'HANLON,  
*Treasurer.*

#### Maintenance Account.

Received from the Treasurer of the State of New York, for the 12 months ending September 30, 1894, in pursuance of resolution of your board,	\$40,000 00
Balance on hand September 30, 1893.....	1,586 74
Total.....	<u>\$41,586 74</u>

I have expended during the 12 months ending September 30, 1894, \$40,906.01, vouchers for which, duly audited by the special auditing committee of the Board of Control, have been furnished to the Comptroller of the State of New York.

Properly classified, the expenditure has been as follows:

By expenses of Board of Control .....	\$753 46
By cartage, express and freight .....	540 00
By farm implements and tools .....	334 75

By fuel .....	\$524 27
By gas .....	579 27
By general supplies .....	2,675 48
By labor .....	14,921 34
By library .....	201 97
By manure and fertilizer.....	172 50
By miscellaneous expenses .....	84 00
By printing .....	1,332 96
By repairs .....	1,518 37
By salaries .....	12,793 20
By stationery .....	3 <sup>24</sup> 20
By telegraph and telephone.....	90 49
By traveling expenses.....	1,062 22
By water .....	232 00
By farm and grounds' .....	178 78
By insurance .....	254 66
By live stock .....	149 00
By scientific apparatus .....	245 45
By greenhouse .....	672 64
By furniture .....	12 00
By laboratory department .....	390 00
	<hr/>
	\$40,906 01
Balance on hand .....	680 73
	<hr/>
	\$41,586 74
	<hr/> <hr/>

**Expense of Bulletins and Enforcing Provisions of Chapter 437,  
Laws of 1890.**

**RECEIPTS.**

Balance on hand September 30, 1893.....	\$1,667 11
Received from the Comptroller of the State of New York .....	10,000 00
	<hr/>
	\$11,667 11
	<hr/> <hr/>

## EXPENDITURES.

Chemicals . . . . .	\$631 42
Chemical apparatus . . . . .	412 73
Express, freight and cartage . . . . .	18 97
Fuel . . . . .	553 33
Gas . . . . .	714 89
Insurance . . . . .	75 00
Miscellaneous expenses . . . . .	19 15
Printing and bulletins . . . . .	4,137 92
Salaries . . . . .	4,159 25
Stationery . . . . .	161 08
Travel . . . . .	549 72
Water . . . . .	87 50
Fixtures . . . . .	32 00
Supplies . . . . .	16 95
	<hr/>
	\$11,569 91
Balance on hand . . . . .	97 20
	<hr/>
Total . . . . .	\$11,667 11
	<hr/> <hr/>

## Postage Account.

## RECEIPTS.

Balance on hand September 30, 1893 . . . . .	\$540 00
Received from the Comptroller of the State of New York . . . . .	3,000 00
	<hr/>
	\$3,540 00
	<hr/> <hr/>

## EXPENDITURES.

Postage . . . . .	\$2,698 00
Balance on hand . . . . .	842 00
	<hr/>
	\$3,540 00
	<hr/> <hr/>

I have received from the Comptroller of the State  
of the appropriation under chapter 675, Laws of  
1894, and have expended, upon vouchers audited  
by the Commissioner of Agriculture . . . . . \$280 76

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#### 4 REPORT OF TREASURER OF AGRICULTURAL EXPERIMENT STATION.

I have received from the Comptroller the appropriation, for repairs to farm buildings, of .....	\$1,000 00
I have expended .....	130 17
	<hr/>
Balance on hand .....	\$869 83
	<hr/> <hr/>

I have received from the Comptroller, for forcing-houses, \$5,000, and have expended for their construction, under resolutions of the board and contract for the same, \$5,000.

Vouchers for all these expenditures, duly audited by the special auditing committee of the Board of Control, have been furnished to the Comptroller of the State of New York.

I have remitted to the State Treasurer \$166.88, the amount received for produce sold during the past fiscal year.

I have a balance of \$72.50 from appropriations for cold-storage, icehouse and completion of laboratory.

# REPORT OF THE DIRECTOR.

---

PETER COLLIER, A. M., M. D., Ph. D.

---

*To the Board of Control of the New York Agricultural Experiment Station:*

GENTLEMEN.—I submit herewith the thirteenth annual report of the Experiment Station for the calendar year 1894.

During the past year the executive committee of the Board of Control have continued their meetings at the station, at which meetings the detailed monthly statements of the several members of the staff have been submitted by the Director for consideration, also a brief statement of the work of the coming month and necessary expenses to be incurred.

At such meetings also the treasurer has furnished a statement of the expenditures and the balances remaining of the several appropriations for the station, general and special, so that through their committee the Board of Control have been constantly advised of the nature and progress of the work being carried forward by each member of the staff and of the labor force employed. The auditing committee of the Board of Control have met as usual the first Friday of each month.

## **Some of the Principal Improvements Made During 1894.**

Grading around vegetable forcing-houses, terracing, sodding terraces and lawn in front and around the houses, and making roadways.

Completing banks around icepond by re-enforcing with earth from the hillside about 10 rods distant.

A great improvement has been made in the pasture field by strengthening the banks of the creek running through it and stoning them up where they were weak and liable to break and destroy the icepond, or cut through and follow old water-courses.

The old planthouse has been taken down and the material it contained has been used, so far as available, in the construction

of a new house on a site just east of the vegetable forcing-houses built in 1893. The old excavations under and around the house removed have been filled and partially graded off for laying down in lawn the coming spring.

A very convenient and commodious root-cellar has been built out of the stones and brick left out of the walls of the old planthouse. The earth dug from the cellar, added to that excavated from the new greenhouse site, was used to grade up where the planthouse formerly stood. The earth necessary to complete the filling was taken from the bank in the pasture field mentioned in connection with the work at the icepond.

The office and potting shed in connection with the old greenhouse has been moved to a site just south of the windmill, placed on a foundation taken from the old walls, and will be used for storing fertilizers.

A two-inch matched hemlock floor has been laid in main alleyway, in horse barn, and a system of ventilation provided by cutting through the walls. The old cistern on the north of the front wall was drained from the bottom, and holes cut from the stable into this to provide additional ventilation on this side. It has also given us a dry wall on this side, and much improved the sanitary condition of the stable.

A new floor has been laid through the main alley of the pig barn also, and ventilation provided as in the instance of the horse stables above mentioned. Repairs have been made to a greater or less extent on all of the buildings connected with the station.

A flagstaff 100 feet high, for displaying weather signals, has been erected to replace the old one which was carried away by the wind.

#### Bulletins Published During the Year 1894.

Bulletin No. 64, January, pp. 24.—Strawberries. Part I. Some Experiences with Strawberries. Part II. Strawberry Crosses.

Bulletin No. 65, January, pp. 135.—Investigation Relating to the Manufacture of Cheese. In five parts. Part IV.

Bulletin No. 66, January, pp. 24.—Analyses of Commercial Fertilizers Collected in the Fall of 1893.

Bulletin No. 67, February, pp. 23.—Experiments in Preventing Pear Scab in 1893.

■ Bulletin No. 68, March, pp. 45.—Investigation Relating to the Manufacture of Cheese. In five parts: Part V. Fat in Milk as a Practical Basis for Determining the Value of Milk for Cheese-making.

Bulletin No. 69, March, pp. 53.—Vegetables Grown for Exhibition.

Bulletin No. 70, April, pp. 17.—Some Reasons Why the Legal Milk Standard of New York State Should be Changed.

Bulletin No. 71, May, pp. 22.—Some Reasons Why there Should be a Legal Standard for Cheese in New York State.

Bulletin No. 72, June, pp. 8.—Preventing Leaf Blight of Plum and Cherry Nursery Stock.

Bulletin No. 73, July, pp. 33.—Analyses of Commercial Fertilizers Collected during the Spring of 1894.

Bulletin No. 74, September, pp. 26.—Observations on the Application of Fungicides and Insecticides.

Bulletin No. 75, September, pp. 22. In two parts: Part I. Some Insects Injurious to Squash, Melon and Cucumber Vines. Part II The Asparagus Beetle.

Bulletin No. 76, October, pp. 18.—Notes on Strawberries for 1894.

Bulletin No. 77, November, pp. 29.—Comparison of Different Breeds of Dairy Cattle. In three parts: Part I. The Cost of Milk Production.

Bulletin No. 78, November, pp. 28.—Comparison of Different Breeds of Dairy Cattle. In three parts: Part II. The Cost of Butter and Cream Production.

Bulletin No. 79, November, pp. 21.—Comparison of Different Breeds of Dairy Cattle. In three parts: Part III. The Cost of Cheese Production.

Bulletin No. 80, November, pp. 51.—Alfalfa Forage for Milch Cows: The Results from Rations Containing Alfalfa and Those Obtained from Some Other Summer Rations.

Bulletin No. 81, December, pp. 13.—Variety Tests with Blackberries, Dewberries and Raspberries. Raspberry Anthracnose.

#### Experiments with Poultry and Swine.

1. Continuation of breeding experiment with laying hens.
2. Chicks raised in connection with above.
3. Feeding experiments with pigs of different breeds.

**Chemistry.**

1. Investigation relating to the manufacture of cheese in factories during the season of 1894.
2. Study of the composition of milk, cheese and whey.
3. Influence of artificial acids in cheese-making upon the yield and quality of cheese.
4. Variation in rennet test with milk of different cows.
5. Loss of milk constituents in cheese-making.
6. Relation of composition of milk to yield of cheese.
7. Determination of casein, albumen and albumose in milk.
8. The cost of milk production with different breeds of cows.
9. The cost of butter and cream production with different breeds of cows.
10. The cost of cheese production with different breeds of cows.
11. Comparative profits derived from selling milk, butter, cream, and cheese.
12. Experiments with different forms of nitrogenous fertilizers.
13. Analyses of commercial fertilizers.

**Horticulture.**

1. Forcing vegetables.
2. Testing varieties of small fruits, grapes, stone fruits and pomaceous fruits.
3. Plant breeding for the purpose of originating improved varieties of fruits.
4. Treatment of pear seedlings for prevention of leaf blight.
5. Treatment of pear orchard for the prevention of scab.
6. A study of raspberry anthracnose and testing methods for controlling the same.
7. A comparison of apparatus for applying fungicides and insecticides.
8. A study of a Bermuda lily disease.

**Entomology.**

1. A study of insects injurious to squash, melon and cucumber vines.
2. A report on the asparagus beetle.

3. A study of insects infesting late cabbages.
4. Investigation as to the prevalence of the San José scale insect and remedial measures for same.
5. Investigation of a Lecanium scale insect occurring on various woody plants, and which is especially injurious to plums, and experiments in fighting this insect.

### The Investigation of Different Breeds of Dairy Cattle.

In the investigation which now for several years has been continued at this Station of several leading breeds of dairy cattle, there has somewhat widely if not generally existed a misconception as to the leading object and aim of this investigation, which, while arising naturally enough, has largely tended to eclipse what has appeared to be the more important subjects of investigation and directed attention to other matters of less importance and to conclusions less valuable, at least in this, that the data at hand were too limited to draw other than but limited conclusions.

For example, it has not been contemplated to carry forward, even upon a limited scale, what may be termed "a battle of the breeds," nor has it been proposed to carry forward a series of either breeding or feeding experiments with our cattle.

Whatever conclusions may be drawn from the elaborate test made with selected representatives of three of our leading breeds of dairy cattle at Chicago, it would hardly appear possible to determine the relative value of the different rations fed these animals, even without consideration of the ulterior effects upon the animals themselves. Nor indeed is our present knowledge of feeding such that we may feel certain that even by a mere interchange of rations the several herds under investigation at Chicago would not have given results widely different from those secured. When, in addition, we consider that the representatives of these several breeds were solely selected for this competitive trial on account of their exceptional and established superiority, the practical worthlessness of this series of tests is obvious, giving, in fact, no practical result of any value whatever to the average dairyman as a guide to him in the management of his herds, by which, with increased knowledge, more valuable practical results could be secured.

We have at the Station, mainly as gifts outright to the State by the several breeding associations, representatives of seven of our leading breeds of cattle. In no case has any animal been added to the herd, having already established a record, and in nearly all cases the animals were secured as young calves, those having, however, been chosen which, from their pedigree and the performance of their ancestors, gave reason to suppose that they would prove satisfactory representatives of their several breeds. While, as a rule, the herd is composed of valuable animals, it is a matter for congratulation rather than regret, that there is not among the number any animal which may be counted in any way phenomenal, nor is there an animal so exceptional that she may not illustrate the typical characters of the breed in the many ways by which such types may be recognized.

Of these seven breeds, six are of those which, in one section of the world or another, have for many generations held an established and deserved position. The exception is a breed largely developed by a single breeder in this State, but from an ancestry contemporaneous with those of our oldest breeds.

It is idle, therefore, to have anticipated that any fair tests were likely to disprove the practical conclusions which in some cases a century at least of experience had fully established, nor has the work of the Station been in the past nor at present is it being prosecuted to such end.

In short the work upon which this Station is engaged is in the comparison of the different breeds, and not in competition except incidentally, and thus far there have been developed such valuable results as to fully justify all time and expense. While it is doubtless true that no two samples of milk, even of the same cow, are quite alike, it is more true that marked differences characterize the milk of different breeds, and that these differences have been perhaps established by many centuries of accidental or intentional conditions. These differences exist and will probably continue and will probably come to be recognized ultimately in determining the special purpose for which a dairy is intended. To declare, therefore, that a certain breed, in a certain section and for a certain purpose, is likely to prove most desirable, by no means is to give to such breed any other than a

local advantage, which even a change of location or other condition might not modify.

I have already disclaimed any intention in our investigation of entering upon feeding experiments other than those incidental to our work. In our ordinary practice we use in winter feeding, besides different hays, roots and ensilage, and during the growing season hay and various forage crops, with more or less grain continuously, and are enabled thus to study the effect of the several rations fed, as has been already shown in another portion of this report; but the aim has always been to give what would be admitted to be a good ration, differing as it naturally would in the different seasons, rather than to study certain rations the effect of which was to be determined. Therefore it rarely if ever happens that a single grain feed has been given, but varying mixtures of those most convenient for feeding and introducing such changes as seemed desirable. In this manner there has accumulated a vast amount of data, indirectly ascertained, as we may say, in our investigations, but none the less valuable, as tending to throw light upon the question of food rations, and this data it is proposed to present from time to time in bulletins, as the work progresses.

Finally I can not refrain from again quoting from an address made many years ago by Professor Samuel W. Johnson, the veteran director of the Connecticut Agricultural Experiment Station of New Haven, who in urging the importance of such an investigation as has been now for several years in progress at this Station, declared: "In some scientific books the opinion is confidently put forth that if you increase the quantity of fat in the fodder you increase the relative quantity of butter in the milk. It is a matter of some consequence to know these things. When we have made four or five series of careful experiments in which we have weighed the milk in all its parts, the fat, casein, the sugar and salts, separately, and we have weighed the food in all its parts in the same manner, so that we know exactly what went into the cow and what came out of her, we are in a position to know what are the facts. It is not my opinion or your opinion, it is not a case of 'I guess so,' or 'It can't be otherwise;' all that has little real value unless there be behind it an evident basis of impregnable facts."

NAMES AND BREEDS OF COWS UNDER INVESTIGATION.  
*Dates of Birth and of Calving.*

TABLE 1.

NAME OF COW.	When born.	Date of calving, first period of lactation.	Date of calving, second period of lactation.	Date of calving, third period of lactation.	Date of calving, fourth period of lactation.	Date of calving, fifth period of lactation.
<i>Ayrshires.</i>						
Queen Duchess .....	Feb. 21, 1888	July 24, 1890	Nov. 24, 1891	Dec. 6, 1892	.....	.....
Junietta Peerless .....	July 26, 1888	Feb. 4, 1891	May 2, 1892	May 5, 1893	May 30, 1894	.....
Manton Belle .....	June 16, 1888	Dec 11, 1890	Dec. 29, 1891	Nov. 21, 1892	Dec 12, 1893	.....
Miss Flow 5th .....	Mar. 1, 1888	Feb. 5, 1890	Feb. 18, 1891	May 6, 1892	Apr. 20, 1893	May 12, 1894
<i>Jerseys.</i>						
Gilderbloom .....	Apr. 6, 1888	Sept. 9, 1890	Feb. 29, 1892	Apr. 13, 1893	.....	.....
Countess Flavia .....	May 14, 1888	Apr. 19, 1890	Nov. 14, 1891	Nov. 12, 1892	Nov. 4, 1893	.....
Barbara Allen .....	Aug. 18, 1888	Aug. 29, 1890	Apr. 11, 1892	May 4, 1893	Apr. 17, 1894	.....
Albert's Carol .....	Jan. 12, 1890	Mar. 26, 1892	Oct. 31, 1893	Oct. 19, 1894	.....	.....
<i>American Holderness.</i>						
Nellie 6th .....	Aug. 10, 1888	Sept. 13, 1890	Nov. 26, 1891	Dec. 12, 1893	.....	.....
Maggie 6th .....	Aug. 15, 1888	Sept. 25, 1890	May 17, 1892	May 18, 1893	May 11, 1894	.....
Nora .....	Sept. 25, 1890	Dec. 17, 1893	.....	.....	.....	.....
<i>Guernseys.</i>						
Rosette Ford .....	May 10, 1888	Nov. 14, 1890	Jan. 30, 1893	.....	.....	.....
Oriole .....	Aug. 25, 1888	Dec. 7, 1890	Dec. 8, 1892	Feb. 25, 1894	.....	.....
Stella Select .....	Dec. 8, 1889	Feb. 13, 1892	May 29, 1893	June 7, 1894	.....	.....
Madam Select .....	Mar. 8, 1889	Dec. 8, 1891	Oct. 13, 1892	.....	.....	.....

<i>Devons.</i>							
Ione.....	Mar. 5, 1888	Mar. 7, 1891	June 30, 1892	June 2, 1893	.....	.....	.....
Genevie's Gift.....	Sept. 19, 1889	May 16, 1891	Oct. 30, 1892	.....	.....	.....	.....
Artalia.....	Jan. 12, 1889	Dec. 24, 1891	June 26, 1893	Mar. 17, 1894	.....	.....	.....
Day Dream B.....	.....	Apr. 29, 1893	.....	.....	.....	.....	.....
<i>Holstein-Friesian.</i>							
Esel 2d.....	June 22, 1888	July 16, 1890	Aug. 28, 1892	.....	.....	.....	.....
Tolsma Artis.....	Apr. 2, 1888	May 24, 1890	May 23, 1891	Aug. 4, 1892	Sept. 21, 1893	.....	.....
Netherland Constance.	July 17, 1890	Oct. 13, 1892	June 24, 1894	.....	.....	.....	.....
Beauty Pledge.....	Mar. 20, 1890	April 5, 1892	Dec. 10, 1893	Nov. 10, 1894	.....	.....	.....
Ruth.....	May 23, 1891	Dec. 4, 1893	Oct. 29, 1894	.....	.....	.....	.....
<i>Shorthorns.</i>							
Betsey 10th.....	Nov. 18, 1889	May 5, 1892	Nov. 25, 1893	.....	.....	.....	.....
Lady Spencer.....	Jan. 9, 1890	Oct. 18, 1892	Feb. 2, 1894	.....	.....	.....	.....

### Quality and Quantity of Food Fed.

The following table, which is a continuation of similar tables in the Tenth, Eleventh and Twelfth Annual Reports, gives the kind and amount of each food eaten by each animal during each month of the experiment, and it will serve as a guide to those who may desire, during the different months of the year, to supply their animals with a similar ration.

Letters of inquiry are frequently addressed to the Station asking for information as to the rations needed for production of the best results, a question of the greatest practical importance to the dairyman, but yet one concerning which I think the correct answer remains largely for future determination, but by consulting the following table one may learn what ration was fed the several animals of our herd each month in the year, and by comparing with other tables presented in this report the effect of such feed, as also of the changes from one kind of feed to another, may be determined, and the knowledge thus obtained is sure to be of interest and may be of great value by way of suggesting certain experiments indicated by the results here recorded. As is well known to the practical feeder, very marked differences are found to result from simply a change of feed without regard to the difference in composition of such feed, and the following pages will record many such changes made with our herd and the results presumably produced thereby.

TABLE 2. FOOD FED COWS DURING EXPERIMENTS.  
First Period of Lactation, continued from Twelfth Annual Report.

	NAME.	Pounds hay.	Pounds ensilage.	Pounds green forage.	Pounds roots.	Pounds mixed grain.
1893.						
December ...	Nora .....	93.2	278.0	.....	87.0	30.7
December ...	Lady Spencer .....	238.6	1271.9	.....	.....	45.5
December ...	Netherland Constance .....	184.9	1298.8	.....	.....	157.5
December ...	Ruth .....	220.5	881.7	.....	67.0	93.2
December ...	Day Dream B. ....	114.9	1300.2	.....	.....	123.8
1894.						
January ...	Nora .....	204.9	751.0	.....	*35.6	166.0
January ...	Netherland Constance .....	265.5	758.4	.....	*73.6	180.5
January ...	Ruth .....	267.9	927.0	.....	*54.0	224.0
January ...	Day Dream B. ....	179.0	736.7	.....	*42.5	126.0
February ...	Nora .....	184.2	700.0	.....	*25.1	177.0
February ...	Netherland Constance .....	242.1	699.6	.....	*57.1	168.0
February ...	Ruth .....	240.7	840.0	.....	*50.9	210.0
February ...	Day Dream B. ....	187.5	672.0	.....	*25.8	113.0
March ...	Nora .....	139.6	1397.8	.....	.....	185.0
March ...	Netherland Constance .....	181.5	1360.2	.....	.....	155.5
March ...	Ruth .....	185.7	1526.8	.....	.....	219.6
March ...	Day Dream B. ....	151.8	1014.1	.....	.....	31.0
April ...	Nora .....	171.9	1056.9	.....	.....	165.0
April ...	Netherland Constance .....	268.6	1022.6	.....	.....	81.5
April ...	Ruth .....	312.4	1013.0	.....	.....	147.1
April ...	Day Dream B. ....	202.2	689.6	.....	.....	.....

\* Corn stalks.

TABLE 2. FOOD FED COWS DURING EXPERIMENTS—(Concluded)

	NAME.	Pounds hay.	Pounds ensilage.	Pounds green forage.	Pounds roots.	Pounds mixed graind.
1894.						
May .....	Nora .....	188.1	349.9	852.7	.....	167.5
May .....	Netherland Constance .....	269.2	297.8	661.7	.....	.....
May .....	Ruth .....	276.1	350.0	885.0	.....	128.4
June .....	Nora .....	143.2	.....	1510.8	.....	136.4
June .....	Ruth .....	208.3	.....	1657.4	.....	99.3
July .....	Nora .....	108.3	.....	1521.3	.....	119.1
July .....	Ruth .....	202.3	.....	1687.9	.....	111.3
August .....	Nora .....	.....	1314.0	572.0	.....	119.1
August .....	Ruth .....	.....	1363.0	620.0	.....	139.3
September .....	Nora .....	.....	.....	1892.9	.....	96.0
September .....	Ruth .....	.....	.....	1761.6	.....	55.1
October .....	Nora .....	346.9	.....	628.6	.....	113.5
October .....	Ruth .....	379.7	.....	.....	306.0	8.0

TABLE 3. FOOD FED COWS DURING EXPERIMENTS.  
*\* Second Period of Lactation, continued from Twelfth Annual Report.*

	NAME.	Pounds hay.	Pounds ensilage	Pounds green forage.	Pounds roots.	Pounds mixed grain.
1893.						
December ..	Albert's Carol.....	150.3	1332.3	.....	.....	160.5
December ..	Rosette Ford.....	184.6	1546.5	.....	.....	232.5
December ..	Oriole .....	145.3	1417.7	.....	.....	148.2
December ..	Stella Select.....	176.6	1400.2	.....	.....	191.2
December ..	Betsey 10th.....	184.5	1420.1	.....	.....	171.0
December ..	Beauty Pledge .....	148.3	760.0	.....	65.0	89.0
December ..	Artalia .....	152.8	1438.7	.....	.....	201.5
1894.						
January ....	Albert's Carol.....	220.8	760.9	.....	*40.7	224.0
January ....	Rosette Ford.....	257.2	928.0	.....	*82.9	217.0
January ....	Oriole .....	63.7	324.7	.....	*47.1	.....
January ....	Stella Select.....	239.7	655.6	.....	*50.0	28.0
January ....	Betsey 10th.....	257.7	929.7	.....	*72.3	247.7
January ....	Beauty Pledge .....	271.0	929.5	.....	*106.0	262.0
January ....	Artalia .....	223.3	828.4	.....	*51.0	201.0
February ...	Albert's Carol.....	214.0	693.5	.....	*28.7	210.0
February ...	Rosette Ford.....	232.8	818.7	.....	*45.4	161.5
February ...	Stella Select.....	226.1	553.3	.....	*38.8	17.2
February ...	Betsey 10th.....	236.7	839.4	.....	*53.8	223.9
February ...	Lady Spencer .....	224.8	475.0	*18.1	178.0	144.0
February ...	Beauty Pledge .....	255.0	840.0	.....	*102.8	252.0

\* Corn stalks.

TABLE 3. FOOD FED COWS DURING EXPERIMENTS — (Concluded).

	NAME.	Pounds hay.	Pounds ensilage.	Pounds green forage.	Pounds roots.	Pounds mixed grain.
1894.						
February ..	Artalia .....	179.4	738.7	.....	*34.7	172.4
March .....	Albert's Carol.....	172.9	1025.5	.....	.....	232.5
March .....	Rosette Ford.....	185.1	1345.1	.....	.....	70.5
March .....	Stella Select.....	185.1	1093.2	.....	.....	248.0
March .....	Betsy 10th.....	212.3	1441.7	.....	.....	.....
March .....	Lady Spencer.....	216.1	1519.6	.....	.....	242.8
March .....	Beauty Pledge.....	216.9	1542.0	.....	.....	279.0
March .....	Artalia .....	72.7	513.6	.....	.....	.....
April .....	Albert's Carol.....	232.7	727.9	.....	.....	225.0
April .....	Rosette Ford.....	249.3	419.2	.....	.....	.....
April .....	Stella Select.....	269.0	839.8	.....	.....	.....
April .....	Betsy 10th.....	295.4	1019.8	.....	.....	217.4
April .....	Lady Spencer.....	314.7	1200.0	.....	.....	240.0
April .....	Beauty Pledge.....	313.0	1111.0	.....	.....	244.0
May .....	Albert's Carol.....	220.2	265.1	799.7	.....	222.5
May .....	Stella Select.....	295.7	155.0	.....	400.0	.....
May .....	Betsy 10th.....	274.1	346.6	856.6	.....	211.9
May .....	Lady Spencer.....	297.9	425.0	1020.1	.....	239.0
May .....	Beauty Pledge.....	308.0	350.0	941.5	.....	239.5
June .....	Albert's Carol.....	148.6	.....	1206.9	.....	184.5
June .....	Betsy 10th.....	207.7	.....	1603.4	.....	195.0
June .....	Lady Spencer.....	240.0	.....	1769.8	.....	210.0
June .....	Netherland Constance.....	65.1	.....	60.4	52.0	19.5

June	Beauty Pledge	211.0	.....	1682.6	.....	203.0
July	Albert's Carol	132.9	.....	999.1	.....	186.0
July	Betsy 10th	179.8	.....	1596.8	.....	193.8
July	Lady Spencer	231.2	.....	1743.3	.....	209.9
July	Netherland Constance	173.9	.....	1641.1	.....	145.2
July	Beauty Pledge	195.9	.....	1522.4	.....	117.8
August	Albert's Carol	.....	937.1	400.6	.....	155.0
August	Betsy 10th	.....	1326.5	634.4	.....	182.4
August	Lady Spencer	.....	145.0	697.8	.....	184.9
August	Netherland Constance	.....	1329.1	683.4	.....	176.1
August	Beauty Pledge	.....	1340.8	701.5	.....	163.0
September	Albert's Carol	.....	.....	1411.1	.....	27.5
September	Betsy 10th	.....	.....	1981.2	.....	150.9
September	Lady Spencer	.....	.....	2184.1	.....	179.2
September	Netherland Constance	.....	.....	2174.3	.....	162.2
September	Beauty Pledge	.....	.....	1948.3	.....	86.5
October	Betsy 10th	405.4	.....	722.0	.....	150.5
October	Lady Spencer	460.5	.....	793.5	.....	202.5
October	Netherland Constance	457.5	.....	827.7	.....	197.5
October	Beauty Pledge	397.8	.....	.....	331	.....

\* Corn stalks.

TABLE 4. *FOOD FED COWS DURING EXPERIMENTS.*  
*Third Period of Lactation, continued from Twelfth Annual Report.*

	NAME.	Pounds hay.	Pounds ensilage.	Pounds green forage.	Pounds roots.	Pounds mixed grain.
1893.						
December ...	Gilderbloom	148.8	1409.6	.....	.....	186.0
December ...	Barbara Allen	185.3	1547.3	.....	.....	232.5
December ...	Junietta Peerless	183.8	1547.0	.....	.....	246.7
December ...	Maggie 6th	151.6	1307.0	.....	.....	248.0
1894.						
January ...	Gilderbloom	197.9	667.9	.....	*43.4	186.0
January ...	Barbara Allen	206.8	926.9	.....	*76.8	232.0
January ...	Junietta Peerless	262.0	929.6	.....	*76.5	221.7
January ...	Maggie 6th	230.9	769.6	.....	*43.9	234.5
February ...	Gilderbloom	195.1	699.6	.....	*45.1	168.0
February ...	Barbara Allen	232.4	720.9	.....	*56.7	119.0
February ...	Oriole	98.9	.....	*35.3	26.2	11.0
February ...	Junietta Peerless	240.7	840.0	.....	*58.8	186.9
February ...	Maggie 6th	120.3	496.1	.....	*30.6	106.0
March ...	Gilderbloom	173.8	1334.5	.....	.....	186.0
March ...	Barbara Allen	229.2	745.9	.....	216.9	.....
March ...	Oriole	173.8	1304.3	.....	.....	.....
March ...	Junietta Peerless	184.3	1468.8	.....	.....	140.5
March ...	Artalia	74.0	461.7	.....	.....	114.1
April ...	Gilderbloom	211.4	974.3	.....	.....	.....
April ...	Barbara Allen	40.0	.....	.....	80.0	180.0
April ...	Oriole	269.0	1057.1	.....	.....	180.0

April	Junietta Peerless	253.8	833.0	.....	100.0	15.0
April	Artalia	236.9	908.0	.....	.....	30.0
May	Gilderbloom	188.4	808.4	818.0	.....	177.0
May	Oriole	266.7	350.0	884.7	.....	211.5
May	Junietta Peerless	32.9	.....	.....	60.0	.....
May	Artalia	200.6	310.3	774.4	.....	85.4
June	Gilderbloom	138.2	.....	1398.8	.....	139.8
June	Oriole	208.8	.....	1604.4	.....	191.0
June	Stella Select	177.9	.....	892.0	65.0	71.8
June	Artalia	149.0	.....	1491.0	.....	90.0
July	Gilderbloom	129.5	.....	1138.1	.....	88.5
July	Oriole	203.9	.....	1646.0	.....	201.5
July	Stella Select	184.9	.....	1660.2	.....	124.0
July	Artalia	144.0	.....	1455.8	.....	93.0
August	Gilderbloom	.....	902.4	518.7	.....	93.0
August	Oriole	.....	1320.0	654.6	.....	157.5
August	Stella Select	.....	1268.8	692.7	.....	123.9
August	Artalia	.....	1208.9	548.9	.....	93.0
September	Gilderbloom	.....	.....	1513.8	.....	90.0
September	Oriole	.....	.....	2032.8	.....	156.2
September	Stella Select	.....	.....	1856.9	.....	91.4
September	Artalia	.....	.....	1723.1	.....	90.0
October	Gilderbloom	240.6	.....	510.7	.....	34.0
October	Oriole	366.3	.....	726.9	.....	187.0
October	Artalia	300.6	.....	622.4	.....	93.0

\* Corn stalks.

TABLE 5.  
FOOD FED COWS DURING EXPERIMENTS.  
*Fourth Period of Lactation, continued from Twelfth Annual Report.*

	NAME.	Pounds hay	Pounds ensilage.	Pounds green forage.	Pounds roots.	Pounds mixed grain.
1893.						
December...	Countess Flavia	166.6	1435.6	.....	.....	185.0
December...	Manton Belle	138.5	669.8	.....	33.0	99.0
December...	Miss Flow 5th	182.1	1383.3	.....	.....	248.0
1894.						
January	Countess Flavia	244.0	860.9	.....	*64.9	224.0
January	Manton Belle	271.3	465.9	.....	*90.9	165.8
January	Miss Flow 5th	256.7	783.0	.....	*67.0	223.0
February	Countess Flavia	231.9	765.0	.....	*50.5	210.0
February	Manton Belle	247.6	773.6	.....	*83.4	207.7
February	Miss Flow 5th	231.7	662.2	.....	*49.6	147.0
March	Countess Flavia	183.8	1394.0	.....	.....	232.5
March	Manton Belle	216.7	1456.7	.....	.....	200.7
March	Miss Flow 5th	53.7	300.4	.....	.....	16.5
April	Countess Flavia	251.9	951.7	.....	.....	225.0
April	Barbara Allen	145.1	194.3	.....	68.6	56.2
April	Manton Belle	314.7	1143.0	.....	.....	180.0
May	Countess Flavia	234.7	346.0	840.0	.....	222.5
May	Barbara Allen	263.4	347.4	909.8	.....	209.0
May	Manton Belle	296.9	369.3	938.1	.....	211.5
May	Maggie 6th	122.4	.....	636.9	.....	104.0
June	Countess Flavia	145.0	.....	1286.9	.....	185.5

June .....	Barbara Allen .....	210.0	.....	1624.3	.....	195.0
June .....	Junietta Peerless .....	193.1	.....	1311.1	57.9	168.9
June .....	Manton Belle .....	237.5	.....	1785.7	.....	196.0
June .....	Maggie 6th .....	94.8	.....	1363.3	.....	183.5
July .....	Countess Flavia .....	128.6	.....	1245.4	.....	134.7
July .....	Barbara Allen .....	215.7	.....	1643.6	.....	214.0
July .....	Junietta Peerless .....	181.4	.....	1625.6	.....	201.5
July .....	Manton Belle .....	214.9	.....	1747.9	.....	145.6
July .....	Maggie 6th .....	105.7	.....	1345.7	.....	186.0
August .....	Countess Flavia .....	.....	1056.5	521.8	.....	134.0
August .....	Barbara Allen .....	.....	1354.6	618.6	.....	186.9
August .....	Junietta Peerless .....	.....	1363.6	687.5	.....	201.5
August .....	Manton Belle .....	.....	1317.4	691.7	.....	158.0
August .....	Maggie 6th .....	.....	1063.8	502.2	.....	186.0
September ..	Countess Flavia .....	.....	.....	1305.1	.....	43.0
September ..	Barbara Allen .....	.....	.....	2099.8	.....	157.3
September ..	Junietta Peerless .....	.....	.....	2075.1	.....	195.0
September ..	Manton Belle .....	.....	.....	2112.5	.....	163.0
September ..	Maggie 6th .....	.....	.....	1706.6	.....	180.0
October .....	Countess Flavia .....	309.3	.....	.....	307.0	.....
October .....	Barbara Allen .....	397.2	.....	687.2	.....	190.3
October .....	Junietta Peerless .....	403.8	.....	765.6	.....	218.0
October .....	Manton Belle .....	365.6	.....	581.4	.....	44.5
October .....	Maggie 6th .....	308.6	.....	664.2	.....	190.5

\* Corn stalks.

FOOD FED COWS DURING EXPERIMENTS.  
Fifth Period of Lactation.

TABLE 6.

	NAME.	Pounds hay.	Pounds Eenslage	Pounds green forage.	Pounds roots.	Pounds mixed grain.
1894.						
May.....	Miss Flow 5th.....	144.5	.....	613.0	44.0	47.5
June.....	Miss Flow 5th.....	177.2	.....	1694.0	.....	195.0
July.....	Miss Flow 5th.....	166.4	.....	1691.4	.....	214.0
August.....	Miss Flow 5th.....	.....	1297.5	604.0	.....	201.5
September...	Miss Flow 5th.....	.....	.....	2048.8	.....	180.0
October.....	Miss Flow 5th.....	393.8	.....	756.1	.....	202.5

TABLE 7.  
AVERAGE FOOD FED EACH ANIMAL FROM NOVEMBER, 1893, TO NOVEMBER, 1894.  
*Continued from Twelfth Annual Report.*

MONTH.	Pounds hay.	Pounds ensilage.	Pounds green forage.	Pounds roots.	Pounds mixed grain.	Kinds of mixed grain.
1893.						No. 36
December .....	170.0	1397.1	.....	.....	190.2	No. 36
1894.						No. 36
January .....	238.0	800.5	.....	*61.9	207.8	No. 36
February .....	223.6	741.0	.....	*44.2	181.9	No. 37
March .....	188.0	1304.4	.....	.....	203.0	No. 37
April .....	265.5	989.9	.....	.....	200.3	No. 38
May .....	251.2	343.2	876.7	.....	203.7	No. 38
June .....	187.0	.....	1530.7	.....	180.4	No. 39
July .....	170.5	.....	1524.4	.....	161.7	No. 39
August 1 to August 9, inclusive .....	.....	.....	608.2	.....	44.6	No. 40
August 10 to August 31, inclusive .....	.....	1247.5	.....	.....	117.7	No. 41
September 1 to September 15, inclusive .....	.....	.....	934.4	.....	70.0	No. 40
September 16 to September 30, inclusive .....	.....	.....	976.3	.....	73.8	No. 42
October 1 to October 15, inclusive .....	279.0	.....	.....	.....	84.9	No. 42
October 16 to October 31, inclusive .....	105.1	.....	719.4	.....	89.6	No. 43

\* Dry corn stalks.

TABLE 8.  
COMPOSITION BY WEIGHT OF GRAIN MIXTURES.

	Wheat bran.	Gluten meal.	Wheat middlings.	Corn meal	Linseed meal, old process.	Ground oats.	Cottonseed meal.	Gluten feed.
Number 36.....	5	5	2	1	2	1	.....	.....
Number 37.....	6	5	.....	.....	1	.....	2	.....
Number 38.....	5	1	1	2	.....	.....	1	.....
Number 39.....	5	.....	1	5	.....	1	.....	.....
Number 40.....	4	1	1	8	.....	1	.....	.....
Number 41.....	6	2	.....	.....	.....	1	1	.....
Number 42.....	5	1	.....	.....	1	.....	1	.....
Number 43.....	5	.....	1	6	1	.....	1	1

TABLE 9. PROXIMATE CONSTITUENTS OF THE DRY MATTER IN FOODS FED COWS DURING EXPERIMENT.  
*Analyses of cattle foods, 1894.*

FOODS.	Time fed.	Water.	Ash.	Albuminoids	Crude fiber.	Nitrogen free extract	%t.	Invert sugar.	Glucose.	Starch.	Albuminoid nitrogen.	Amide nitrogen.
Mixed grain, No. 36	December 1, 1893, to January 31, 1894	13.68	3.15	30.06	7.17	61.75	7.07	0.46	1.10	42.30	9.70	0.51
Corn ensilage	November 1, 1893, to December 31, 1893	77.90	6.91	7.63	94.83	58.81	9.13	3.06	0.17	32.50	0.50	0.66
Mixed hay	November 1, 1893, to December 31, 1893	15.07	5.43	10.00	33.71	47.59	4.55	3.19	2.83	14.40	1.51	0.69
Beets	November 1, 1893, to December 31, 1893	83.77	12.43	11.56	5.71	67.60	9.50	3.33	37.13	1.85	0.94	0.98
Corn grain, No. 37	January 15, 1894, to February 15, 1894	97.93	12.43	11.56	90.46	53.51	1.92	0.80	0.48	1.50	1.03	0.36
Mixed grain, No. 38	January 1, 1894, to March 31, 1894	11.83	4.15	25.80	6.35	53.53	10.04	1.43	2.95	15.30	3.70	0.33
Clover ensilage	January 1, 1894, to May 1, 1894	17.83	6.46	9.81	31.55	59.26	3.63	1.62	0.43	33.00	0.97	0.43
Clover hay	January 1, 1894, to June 1, 1894	13.83	6.70	9.81	31.19	59.26	3.63	1.62	0.43	33.00	0.97	0.43
Mixed grain, No. 38	April 1, 1894, to June 1, 1894	17.83	6.70	9.81	31.55	59.26	3.63	1.62	0.43	33.00	0.97	0.43
Timothy hay	May 1, 1894, to July 31, 1894	11.70	4.42	7.26	32.94	61.81	6.48	3.09	1.55	34.90	1.40	0.17
Alfalfa forage	May 1, 1894, to June 1, 1894	73.81	1.15	24.31	19.81	53.06	5.68	3.09	0.69	11.60	2.63	0.18
Mixed grain, No. 39	June 1, 1894, to August 1, 1894	11.56	3.72	13.00	6.33	73.57	4.58	1.63	1.59	7.10	2.93	0.37
Alfalfa forage	June 1, 1894, to August 1, 1894	73.27	7.93	15.06	26.73	57.42	4.58	1.63	1.59	7.10	2.93	0.37
Clover hay	June 1, 1894, to July 1, 1894	11.97	6.37	9.69	33.84	48.74	4.54	3.75	3.50	8.30	1.90	0.17
Oat and rice forage	June 1, 1894, to August 1, 1894	67.40	5.83	13.63	33.80	53.40	3.95	3.05	2.59	17.60	1.73	0.36
Ground oats and wheat bran	July 1, 1894, to September 1, 1894	9.4	4.83	13.32	10.04	67.19	4.57	3.05	2.41	11.00	2.03	0.11
Alfalfa forage	July 1, 1894, to October 1, 1894	67.70	6.73	13.10	20.70	43.25	4.14	1.00	1.81	11.00	2.03	0.11
Timothy hay	August 1, 1894, to August 9, 1894	10.99	5.05	15.13	34.59	53.15	3.00	3.40	4.93	6.90	0.64	0.16
Mixed grain, No. 40	Aug. 1, 1894, to Sept. 1, 1894	10.50	2.73	13.13	4.31	74.65	5.19	0.55	1.79	15.30	1.94	0.16
Alfalfa forage	September 1, 1894, to September 15, 1894	73.10	8.63	13.56	26.39	40.08	4.41	1.04	0.83	7.00	2.02	0.25
Oat and rice forage	September 1, 1894, to September 15, 1894	63.80	10.56	14.54	23.34	48.31	3.65	1.75	0.71	13.60	1.83	0.23
Mixed grain, No. 41	August 9, 1894, to September 1, 1894	9.15	5.73	22.31	7.13	57.35	8.18	0.55	3.77	15.90	3.34	0.43
Corn ensilage	August 9, 1894, to September 1, 1894	71.50	4.75	9.66	15.04	63.05	6.70	0.03	0.50	10.90	0.74	0.43
Corn forage	September 1, 1894, to October 1, 1894	73.10	4.15	9.66	15.04	63.05	6.70	0.03	0.50	10.90	0.74	0.43
Mixed grain, No. 42	September 15, 1894, to October 1, 1894	11.10	5.76	27.13	7.39	53.87	6.83	3.60	4.53	35.30	1.11	0.34
Timothy hay	September 15, 1894, to October 1, 1894	11.60	4.59	4.75	33.47	54.87	2.33	3.60	3.59	39.50	4.00	0.37
Alfalfa forage	October 1, 1894, to November 1, 1894	76.50	9.74	23.31	20.57	41.41	4.97	1.43	4.35	13.90	0.69	0.19
Mixed grain, No. 43	October 15, 1894, to November 1, 1894	10.79	3.56	13.87	18.87	67.30	5.64	0.61	1.13	9.30	2.53	0.19
Beets	October 15, 1894, to Dec. 1, 1894	85.57	10.35	9.31	5.44	74.31	0.59	6.86	43.5	3.60	0.75	0.74

**Proximate Composition of Feed Fed and also the Weight of Each Animal for Each Month of the Investigation — General Explanation of Tables 10 to 78.**

The following tables (1 to 9, inclusive) give the number of pounds of each food constituent consumed every month, as also the weight of each animal.

Each table will show very considerable changes in the proximate composition of the several rations, and the result of such changes may be studied with profit in connection with the tables following later, in which tables are given the milk yield and its composition for each month of the experiment.

The tables 10 and 11 are continuations from the Twelfth Annual Report of the *first* period of lactation.

The first gives the food constituents of these three animals, the second gives the amount and composition of the milk yield.

Tables 12 and 13 are continuations from the Twelfth Annual Report of the *second* period of lactation, presenting the same data as to food and milk yield.

Tables 14 and 15 are continuations from the Twelfth Annual Report of the *third* period of lactation for four animals.

Tables 16 to 19, inclusive, give similar data for two animals in their *first* period of lactation.

Tables 20 to 29, inclusive, give similar results for five animals in their *second* period of lactation.

Tables 30 to 35, inclusive, give similar data for three animals in their *third* period of lactation.

Tables 36 to 47, inclusive, give similar data for six animals in their *fourth* period of lactation.

Tables 48 and 49 give similar data for one animal in her *fifth* period of lactation.

Tables 50 to 53, inclusive, give the cost of production of milk and fat for each animal for the *first*, *second*, *third* and *fourth* periods of lactation.

Table 54 gives the average yield of milk and per cent. of fat, for each cow, each month and of each period of lactation.

Table 55 gives the relative cost of production of milk and fat for each animal and for each breed for the *first* period of lactation.

Table 56 gives the relative cost of production of milk and fat for each animal and for each breed for the *second* period of lactation.

Table 57 gives the relative cost of production of milk and fat for each animal and for each breed for the *third* period of lactation.

Table 58 gives the relative cost of production of milk and fat for each animal and for each breed for the *fourth* period of lactation.

Table 59 gives the actual and relative cost of milk, per pound, for each animal and for each breed for *all* periods of lactation.

Table 60 gives the actual and relative cost of fat, per pound, for each animal and for each breed for *all* periods of lactation.

Table 61 gives the number of days in each period of lactation and the milk yield morning and evening.

Table 62 gives the yield of milk of each American Holderness cow, and the per cent. of fat during each month of each lactation period.

The total milk yield as given in tables 62 to 69, inclusive, may not always agree exactly with that given in other tables, as the milk was not always weighed and analyzed to the extreme end of the period of lactation.

Table 63 gives the yield of milk of each Jersey cow and the per cent. of fat during each month of each lactation period.

Table 64 gives the yield of milk of each Guernsey cow and the per cent. of fat during each month of each lactation period.

Table 65 gives the yield of milk of each Holstein-Friesian cow and the per cent. of fat during each month of each lactation period.

Table 66 gives the yield of milk of each Devon cow and the per cent. of fat during each month of each lactation period.

Table 67 gives the yield of milk of each Ayrshire cow and the per cent. of fat during each month of each lactation period.

Table 68 gives the yield of milk of each Shorthorn cow and the per cent. of fat during each month of each lactation period.

Table 69 gives the number of days and daily milk yield in successive periods of lactation for each cow and the averages of each breed.

When a difference is to be seen in the number of days given in this and the following table from those given in tables relating to cost of milk and fat, it is due to the fact that, toward the close of the period, the milk yield was very slight and was taken but once a day. In these cases, in tables like the above, it is obviously unfair to reckon all the days in which milk was given. For this reason, also, the sum of the morning's and evening's milk, as given in the following table, for any particular cow for any given period, will not *always* equal the total amount given in tables relating to milk and fat.

Table 70 gives the relation of fat in food to fat in milk for each animal in her *first* period of lactation. Pure fat estimated at 82.6 per cent. of ether extract in this and following tables.

Table 71 gives the relation of fat in food to fat in milk for each animal in her *second* period of lactation.

Table 72 gives the relation of fat in food to fat in milk for each animal in her *third* period of lactation.

Table 73 gives the relation of fat in food to fat in milk for each animal in her *fourth* period of lactation.

Table 74 gives certain general results as to food and production of each cow during her *first* period of lactation.

Tables 75, 76 and 77 give the same general results as to food and production of each cow during the *second*, *third* and *fourth* periods of lactation.

## LADY SPENCER — SHORTHORN.

*Conclusion of First Period.*

TABLE 10.

MONTH.	Weight.	Albuminoids	Nitrogen free extract.	Starch and sugar. %	Crude fat	Fiber.	Ash.
1893.							
December .....	1498	36.00	290.7	132.0	19.2	141.2	30.4
1894.							
January .....	1549	10.21	73.9	42.2	3.7	35.1	9.3

**DAY DREAM B—DEVON.**  
*Conclusion of First Period.*

MONTH.	Weight.	Albuminoids.	Nitrogen free extract.	Starch and sugar.	Crude fat.	Fiber.	Ash.
1893.							
December .....	990	37.75	286.6	142.3	19.4	112.6	27.5
1894.							
January .....	1048	43.06	254.4	153.7	17.9	98.5	25.2
February .....	1046	46.87	227.2	122.3	19.7	94.0	24.6
March .....	1110	30.62	210.1	122.3	14.1	89.4	23.2
April .....	1076	23.62	174.3	106.5	9.9	84.5	19.8

NETHERLAND CONSTANCE — HOISTEIN-FRIESIAN.  
*Conclusion of First Period.*

MONTH.	Weight.	Albuminoids.	Nitrogen free extract.	Starch and sugar.	Crude fat.	Fiber.	Ash.
1893.							
December .....	1060	48.31	332.5	166.8	24.1	135.2	31.8
1894.							
January .....	1076	58.94	334.2	200.8	23.6	132.1	33.0
February .....	1100	64.00	290.5	152.3	26.3	120.3	31.4
March .....	1175	63.00	324.4	178.6	28.5	122.7	34.6
April .....	1257	45.37	289.7	169.9	18.6	122.8	31.1

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LADY SPENCER — SHORTHORN.  
*Conclusion of First Period.*

TABLE 11.

MONTH.	Milk yield, pounds.	Per cent. solids.	Per cent. fat.	Per cent. casein.	Per cent. sugar.	Per cent. ash.	Pounds solids.	Pounds fat.	Pounds casein.	Pounds sugar.	Pounds ash.
1893. December ..	142.5	15.07	5.45	3.99	5.04	0.59	21.5	7.8	5.7	7.2	0.8
1894. January ....	10.6	14.33	5.12	3.76	4.82	0.63	1.5	0.6	0.4	0.4	0.1

DAY DREAM B—DEVON.

*Conclusion of First Period.*

MONTH.	Milk yield, pounds.	Per cent. solids.	Per cent. fat.	Per cent. casein.	Per cent. sugar.	Per cent. ash.	Pounds solids.	Pounds fat.	Pounds casein.	Pounds sugar.	Pounds ash.
1893.											
December ..	263.7	16.04	5.35	4.29	5.66	0.74	42.3	14.1	11.3	14.9	2.0
1894.											
January.....	213.5	16.39	5.80	4.34	5.67	0.58	35.0	12.4	9.3	12.1	1.2
February...	76.8	16.55	6.00	4.65	5.20	0.70	12.7	4.6	3.6	4.0	0.5
March .....	87.7	16.07	5.40	4.55	5.35	0.7	14.1	4.7	4.0	4.7	0.7
April .....	43.2	16.31	5.70	4.60	5.27	0.74	7.0	2.4	2.0	2.3	0.3

## REPORT OF THE DIRECTOR OF THE

NETHERLAND CONSTANCE — HOLSTEIN-FRIESIAN.  
*Conclusion of First Period.*

MONTH.	Milk yield, pounds.	Per cent. solids.	Per cent. fat.	Per cent. casein.	Per cent. sugar.	Per cent. ash.	Pounds solids.	Pounds fat.	Pounds casein.	Pounds sugar.	Pounds ash.
1893. December ..	696.0	11.67	3.10	3.11	4.89	0.57	81.2	21.6	21.6	34.0	4.0
1894. January.....	631.3	11.80	3.00	3.31	4.83	0.66	74.5	18.9	20.9	30.5	4.2
February ...	287.9	13.85	3.80	4.29	5.04	0.72	39.9	10.9	12.4	14.5	2.1
March .....	143.6	15.17	4.20	5.48	4.71	0.78	21.7	6.0	7.8	6.8	1.1
April .....	78.6	15.59	4.00	6.61	4.25	0.73	12.2	3.1	5.2	3.3	0.6
May .....	33.2	13.17	2.30	6.31	3.88	0.68	4.4	0.8	2.1	1.3	0.3

ARTALIA — DEVON.  
Conclusion of Second Period.

MONTH.	Weight.	Albuminoids.	Nitrogen free extract.	Starch and sugar.	Crude fat.	Fiber.	Ash.
1893.							
December .....	1070	53.25	361.8	186.2	26.4	137.0	33.6
1894.							
January .....	1123	58.69	328.1	201.3	24.3	121.0	31.4
February .....	1136	59.81	263.0	135.9	25.4	101.5	28.0
March .....	1170	12.00	97.6	58.3	5.7	43.1	10.9

ROSETTE FORD — GUERNSEY.  
*Conclusion of Second Period.*

MONTH.	Weight.	Albuminoids.	Nitrogen free extract.	Starch and sugar.	Crude fat.	Fiber.	Ash.
1893.							
December .....	1122	61.19	405.5	209.5	30.1	154.0	37.6
1894.							
January .....	1167	65.44	368.3	224.6	26.9	138.1	35.6
February .....	1189	63.06	394.8	156.6	26.4	120.5	31.8
March .....	1238	45.50	285.3	163.8	21.0	116.6	31.2
April .....	1238	27.31	236.8	89.5	24.5	126.6	26.1

**STELLA SELECT — GUERNSEY.**  
*Conclusion of Second Period.*

MONTH.	Weight.	Albuminoids.	Nitrogen free extract.	Starch and sugar.	Crude fat.	Fiber.	Ash.
<b>1893.</b>							
December .....	926	42.12	323.4	157.6	22.2	136.2	31.7
<b>1894.</b>							
January .....	888	32.37	219.6	127.3	12.7	105.4	24.4
February .....	833	29.00	189.1	118.8	11.3	94.0	21.6
March .....	856	27.69	220.2	132.3	12.7	99.4	24.8
April .....	872	30.31	221.7	135.9	12.5	108.8	25.3
May .....	901	29.74	202.6	110.8	11.1	103.7	27.7

## REPORT OF THE DIRECTOR OF THE

ORIOLE — GUERNSEY.  
*Conclusion of Second Period.*

MONTH.	Weight.	Albuminoids.	Nitrogen free extract	Starch and sugar.	Crude fat.	Fiber.	Ash.
1893.							
December .....	953	44.69	327.5	163.5	22.7	130.3	31.3
1894.							
January .....	1005	32.06	231.2	128.0	13.2	100.1	24.2

ARTALIA—DEVON.  
*Conclusion of Second Period.*

TABLE 13.

MONTH.	Milk yield, pounds	Per cent. solids.	Per cent. fat.	Per cent. casein.	Per cent. sugar.	Per cent. ash.	Pounds solids.	Pounds fat.	Pounds casein.	Pounds sugar.	Pounds ash.
1893.											
December ..	385.4	14.20	4.32	4.15	5.00	0.73	54.7	16.6	16.0	19.3	2.8
1894.											
January ....	341.3	14.18	4.63	4.11	4.76	0.68	48.4	15.8	14.0	16.3	2.3
February...	286.9	14.12	4.45	3.99	5.01	0.67	40.5	12.8	11.4	14.4	1.9
March .....	167.2	16.03	5.50	4.58	5.25	0.70	26.8	9.2	7.6	8.8	1.2

## ROSETE FORD — GUERNSEY.

*Conclusion of Second Period.*

MONTH.	Milk yield, pounds.	Per cent. solids.	Per cent. fat.	Per cent. casein.	Per cent. sugar.	Per cent. ash.	Pounds solids.	Pounds fat.	Pounds casein.	Pounds sugar.	Pounds ash.
1893											
December ..	452.2	16.34	6.10	4.08	5.49	0.67	73.9	27.6	18.5	24.8	3.0
1894.											
January ....	355.9	17.30	6.60	4.64	5.27	0.79	61.6	23.5	16.5	18.8	2.8
February...	169.6	18.40	7.50	4.94	5.08	0.88	31.2	12.7	8.4	8.6	1.5
March .....	95.2	17.85	7.05	4.79	5.17	0.84	17.0	6.7	4.6	4.9	0.8
April .....	35.3	18.12	7.27	4.87	5.12	0.86	6.4	2.6	1.7	1.8	0.3

STELLA SELECT—GUERNSEY.  
*Conclusion of Second Period.*

MONTH.	Milk yield, pounds.	Per cent. solids.	Per cent. fat.	Per cent. casein.	Per cent. sugar.	Per cent. ash.	Pounds solids.	Pounds fat.	Pounds casein.	Pounds sugar.	Pounds ash.
1893.											
December ..	515.1	16.38	6.50	3.81	5.34	0.73	84.4	33.4	19.6	27.6	3.8
1894.											
January ....	315.5	15.32	6.20	3.60	4.87	0.65	48.3	19.6	11.3	15.4	2.0
February ....	205.1	16.46	7.35	3.54	4.97	0.60	33.8	15.1	7.3	10.2	1.2
March .....	197.0	15.04	6.00	3.55	4.87	0.62	29.6	11.8	7.0	9.6	1.2
April .....	144.1	14.89	6.00	3.95	4.29	0.65	21.4	8.6	5.7	6.2	0.9
May .....	55.6	15.22	5.80	4.89	3.84	0.69	8.4	3.2	2.7	2.1	0.4

## ORIOLE — GUERNSEY.

*Conclusion of Second Period.*

MONTH.	Milk y <sup>d</sup> -ld. pounds.	Per cent. solids.	Per cent. fat.	Per cent. casein.	Per cent. sugar.	Per cent. ash.	Pounds solids.	Pounds fat	Pounds casein.	Pounds sugar.	Pounds ash.
1893. December ..	301.0	16.77	7.00	4.14	4.98	0.65	50.5	21.1	12.5	15.0	1.9
1894. January.....	51.6	19.02	7.00	6.81	4.56	0.65	9.8	3.6	3.5	2.4	0.3

MAGGIE 6TH — AMERICAN HOLDERNESS.  
*Conclusion of Third Period.*

TABLE 14.

MONTH.	Weight.	Albuminoids.	Nitrogen free extract.	Starch and sugar.	Crude fat.	Fiber.	Ash.
1893.							
December .....	935	58.87	368.4	195.8	28.4	132.3	33.1
1894.							
January .....	1003	62.31	334.5	208.5	25.7	118.2	31.2
February .....	1050	48.56	240.2	128.7	20.8	99.6	26.0

## REPORT OF THE DIRECTOR OF THE

JUNIETTA PEEBLESS — AYRESHIRE.  
*Conclusion of Third Period.*

MONTH.	Weight.	Albuminoids.	Nitrogen free extract.	Starch and sugar.	Crude fat.	Fiber.	Ash.
1893.	989	63.19	412.9	214.8	31.0	154.7	38.0
December .....							
1894.	1019	67.06	378.3	228.5	27.5	142.7	36.6
January .....							
February .....	1032	70.12	318.5	144.2	29.3	128.5	34.2
March .....	1060	56.05	321.0	180.2	25.8	125.6	34.7
April .....	1092	29.94	237.8	118.3	14.2	111.8	26.7

BARBARA ALLEN — JERSEY.  
*Conclusion of Third Period.*

MONTH.	Weight.	Albuminoids.	Nitrogen free extract.	Starch and sugar.	Crude fat.	Fiber.	Ash.
1893.							
December .....	952	61.25	405.9	209.5	30.1	154.2	37.6
1894.							
January .....	1011	66.75	376.1	227.0	27.4	141.3	36.4
February .....	1023	53.50	266.8	141.9	22.0	115.1	29.2
March .....	1018	29.37	215.3	121.9	13.6	98.6	26.1

GILDERBLOOM — JERSEY.  
*Conclusion of Third Period.*

MONTH.	Weight.	Albuminoids.	Nitrogen free extract.	Starch and sugar.	Crude fat.	Fiber.	Ash.
1883.							
December .....	881	50.37	348.0	178.2	25.1	133.3	32.5
1894.							
January .....	919	52.19	285.6	176.3	21.4	104.2	27.1
February .....	900	60.06	266.4	187.0	25.2	105.6	28.5
March .....	931	68.37	331.7	180.5	30.9	121.8	35.1
April .....	948	55.87	313.1	175.4	22.6	112.5	31.6
May .....	962	76.75	283.1	136.8	26.4	108.1	40.1
June .....	950	65.44	304.2	135.2	24.2	135.5	38.8
July .....	984	59.62	306.4	113.0	21.2	131.0	32.6
August .....	974	40.62	295.9	54.9	28.0	106.3	27.7
September .....	930	51.81	301.7	125.0	19.4	97.8	34.7
October .....	990	35.06	187.0	65.9	12.3	98.9	22.9

MAGGIE 6TH — AMERICAN HOLDERNESS.  
*Conclusion of Third Period.*

TABLE 15.

MONTH.	Milk yield, pounds.	Per cent. solids.	Per cent. fat.	Per cent. casein.	Per cent. sugar.	Per cent. ash.	Pounds solids.	Pounds fat.	Pounds casein.	Pounds sugar.	Pounds ash.
1893. December ..	580.6	13.61	4.20	3.60	5.18	0.63	79.0	24.4	20.9	30.1	3.6
1894. January ....	266.9	15.40	5.27	4.26	5.10	0.77	41.1	14.1	11.4	13.6	2.0
February ...	18.7	16.60	6.05	5.61	4.13	0.81	3.1	1.1	1.0	0.8	0.2

JUNIETTA PEERLESS — AYRESHIRE.  
*Conclusion of Third Period.*

MONTH.	Milk yield, pounds.	Per cent. solids.	Per cent. fat.	Per cent. casein.	Per cent. sugar.	Per cent. ash.	Pounds solids.	Pounds fat.	Pounds casein.	Pounds sugar.	Pounds ash.
1893. December...	888.1	12.53	3.53	3.20	5.23	0.57	111.3	31.3	28.4	46.5	5.1
1894. January....	750.4	13.09	4.05	3.29	5.22	0.53	98.2	30.4	24.7	39.1	4.0
February...	468.6	13.52	3.95	3.63	5.34	0.60	63.3	18.5	17.0	25.0	2.8
March . . .	353.1	13.70	4.00	3.83	5.25	0.62	48.3	14.1	13.5	18.5	2.2
April .....	143.4	13.29	4.20	3.49	5.10	0.50	19.0	6.0	5.0	7.3	0.7

## BARBARA ALLEN—JERSEY.

*Conclusion of Third Period.*

MONTH	Milk yield, pounds.	Per cent. solids.	Per cent. fat.	Per cent. casein.	Per cent. sugar.	Per cent. ash.	Pounds solids.	Pounds fat.	Pounds casein.	Pounds sugar.	Pounds ash.
1893. December ..	587.5	15.95	6.10	3.99	5.20	0.66	93.7	35.8	23.4	30.6	3.9
1894. January ....	541.1	16.10	6.10	3.98	5.35	0.67	87.1	33.0	21.5	29.0	3.6
February ...	406.4	16.21	6.40	3.84	5.32	0.65	65.8	26.0	15.6	21.6	2.6
March .....	169.9	16.21	6.00	4.34	5.15	0.72	27.5	10.2	7.4	8.7	1.2

GILDERBLOOM—JERSEY.  
Conclusion of Third Period.

MONTH	Milk yield, pounds.	Per cent. solids.	Per cent. fat.	Per cent. casein.	Per cent. sugar.	Per cent. ash.	Pounds solids.	Pounds fat.	Pounds casein.	Pounds sugar.	Pounds ash.
1893.											
December ..	495.3	15.31	5.70	3.98	4.96	0.67	75.8	28.2	19.7	24.6	3.3
1894.											
January ....	375.5	15.29	6.27	3.93	4.39	0.70	57.4	23.5	14.8	16.5	2.6
February ...	374.9	15.60	6.20	3.90	4.82	0.68	58.4	23.2	14.6	18.1	2.5
March .....	442.0	14.80	5.60	3.69	4.86	0.65	65.4	24.7	16.3	21.5	2.9
April .....	371.9	14.66	5.20	3.81	4.99	0.66	54.5	19.3	14.2	18.6	2.4
May .....	364.9	14.54	5.70	3.68	4.57	0.64	53.0	20.8	13.2	16.7	2.3
June .....	332.5	14.90	5.60	3.78	4.86	0.66	49.5	18.6	12.6	16.2	2.1
July .....	292.4	14.77	5.80	3.51	4.83	0.63	40.2	15.8	9.6	13.1	1.7
August .....	295.0	15.81	6.60	3.83	4.69	0.69	46.6	19.5	11.3	13.8	2.0
September ..	244.0	15.47	6.25	3.50	5.04	0.68	37.7	15.2	8.5	12.3	1.7
October ....	79.9	15.68	5.85	4.31	4.85	0.67	12.5	4.7	3.4	3.9	0.5

TABLE 16.

NORA — AMERICAN HOLDERNESS.

First Period — Calved December 17, 1893.

MONTH.	Weight.	Albuminoids.	Nitrogen free extract.	Starch and sugars.	Crude fat.	Fiber.	Ash.
1893.							
December .....	983	14.87	100.8	49.9	7.2	.44.5	11.2
1894.							
January .....	832	50.56	285.7	176.4	21.0	106.9	27.6
February .....	784	60.19	258.3	134.6	25.5	99.1	27.4
March .....	821	66.69	326.6	175.4	30.6	116.0	34.8
April .....	847	51.81	299.4	167.2	21.5	105.3	30.2
May .....	879	77.06	286.2	138.3	26.6	110.8	41.1
June .....	829	68.94	317.6	140.2	25.5	144.1	41.2
July .....	901	73.87	387.3	166.9	26.9	153.0	38.9
August .....	881	57.06	388.4	78.5	40.7	131.1	35.2
September .....	906	67.94	364.3	166.0	24.7	116.6	42.0
October .....	941	61.94	290.1	127.1	20.8	139.1	33.2

RUTH — HOLSTEIN-FRIESLAN.  
First Period — Calved December 4, 1893.

TABLE 17.

MONTH.	Weight.	Albuminoids.	Nitr. E-n free extract.	Starch and sugars.	Crude fat.	Fiber.	Ash.
1893.	1168	38.44	264.5	129.9	18.9	118.2	27.7
December .....							
1894.	1084	63.10	372.9	229.6	27.5	139.3	35.9
January .....	1060	74.25	325.2	167.6	31.1	128.4	34.7
February .....	1132	78.75	377.1	203.5	35.6	136.5	39.3
March .....	1140	58.56	342.1	197.3	23.2	138.0	35.8
April .....	1164	78.56	304.2	153.0	26.6	132.0	44.7
May .....	1120	74.06	337.5	151.6	27.1	168.3	46.0
June .....	1180	86.00	451.4	187.1	30.9	192.3	47.1
July .....	1208	61.69	415.8	84.7	43.6	189.5	37.7
August .....	1217	54.94	392.0	137.8	20.9	107.6	37.8
September .....	1237	17.62	221.4	100.0	8.4	115.4	20.4
October .....							

NORA — AMERICAN HOLDERNESS.  
First Period — Calved December 17, 1893.

TABLE 18.

MONTH.	Milk yield, pounds.	Per cent. solida.	Per cent. fat.	Per cent. casein.	Per cent. sugar.	Per cent. ash.	Pounds solida.	Pounds fat.	Pounds casein.	Pounds sugar.	Pounds ash.
1893.											
December...	309.6	14.13	5.10	3.53	4.76	0.74	43.7	15.8	10.9	14.7	2.3
1894.											
January....	809.1	12.37	3.68	2.85	5.23	0.61	100.1	29.8	23.1	42.3	4.9
February....	709.3	12.05	3.56	2.64	5.23	0.63	85.5	25.3	18.7	37.1	4.4
March.....	780.5	12.07	3.70	2.77	5.03	0.58	94.2	28.9	21.6	39.2	4.5
April.....	662.4	12.25	3.60	2.98	5.06	0.61	81.1	23.9	19.7	33.5	4.0
May.....	625.3	12.27	3.70	2.97	5.01	0.59	76.7	23.1	18.6	31.3	3.7
June.....	523.7	12.03	3.40	2.94	5.11	0.58	63.0	17.8	15.4	26.8	3.0
July.....	519.6	12.25	3.57	3.02	5.07	0.59	63.6	18.5	15.7	26.3	3.1
August.....	536.0	12.52	3.60	3.08	5.24	0.60	67.1	19.3	16.5	28.1	3.2
September...	457.8	13.07	3.95	3.03	5.47	0.62	59.8	18.1	13.9	25.0	2.8
October....	204.8	14.03	4.40	3.50	5.50	0.63	28.7	9.0	7.2	11.2	1.3

RUTH — HOLSTEIN-FRIESIAN.  
*First Period — Calved December 4, 1893.*

TABLE 19.

MONTH.	Milk yield, pounds.	Per cent. solids.	Per cent. fat.	Per cent. casein.	Per cent. sugar.	Per cent. ash.	Pounds solids.	Pounds fat.	Pounds casein.	Pounds sugar.	Pounds ash.
1893. December...	793.2	10.84	2.82	2.70	4.70	0.62	86.0	22.4	21.4	37.3	4.9
1894. January....	941.4	10.62	2.79	2.42	4.79	0.62	100.0	26.3	22.8	45.1	5.8
February...	795.9	10.65	2.68	2.55	4.79	0.63	84.7	21.3	20.3	38.1	5.0
March....	849.0	10.92	2.90	2.66	4.79	0.57	92.7	24.6	22.6	40.7	4.4
April.....	69.5	10.88	2.95	2.42	4.69	0.62	75.0	20.3	18.1	32.3	4.3
May.....	693.2	11.21	3.05	2.70	4.86	0.60	71.0	19.3	17.1	30.8	3.8
June.....	538.4	11.23	2.90	2.72	4.98	0.63	60.5	15.6	14.7	26.8	3.4
July.....	430.4	11.63	2.92	3.14	4.90	0.67	50.1	12.6	13.5	21.1	2.9
August.....	356.2	11.76	2.95	3.21	4.93	0.67	41.9	10.5	11.4	17.6	2.4
September...	226.6	11.77	3.25	2.99	4.90	0.63	26.7	7.4	6.8	11.1	1.4
October....	99.4	13.30	4.30	3.73	4.64	0.63	12.0	3.9	3.4	4.2	0.5

NETHERLAND CONSTANCE—HOLSTEIN-FRIESIAN.  
Second Period—Calved June 24, 1894.

TABLE 20.

MONTH.	Weight.	Albuminoids.	Nitrogen free extract.	Starch and sugars.	Crude fat.	Fiber.	Ash.
1894.							
June.....	1261	8.31	58.3	24.2	3.2	24.3	5.9
July.....	1018	85.69	452.8	191.3	31.1	182.5	45.7
August .....	1004	70.75	439.6	91.4	46.3	146.2	40.1
September.....	987	86.94	445.9	198.4	31.3	137.8	50.7
October .....	1003	90.25	408.8	185.3	30.0	185.9	45.6

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BEAUTY PLEDGE - HOLSTEIN-FRIESIAN.  
*Second Period — Calved December 10, 1893.*

TABLE 21.

MONTH	Weight.	Albuminoids.	Nitrogen free extract.	Starch and sugars.	Crude fat.	Fiber.	Ash.
1893.							
December .....	1210	29.12	216.1	107.6	15.7	90.6	21.7
1894.							
January .....	1069	75.06	414.9	247.7	30.5.	154.2	39.7
February .....	1059	86.37	370.0	181.4	35.7	146.6	39.6
March .....	1071	93.38	419.0	223.4	41.7	149.6	43.9
April .....	1065	74.87	407.8	229.0	29.5	149.3	41.1
May .....	1074	100.35	382.3	190.7	34.3	149.9	52.0
June .....	1070	85.77	407.8	186.3	3.6	176.5	50.1
July .....	1106	80.62	423.1	176.9	28.9	178.6	44.1
August .....	1089	70.75	437.0	84.5	45.9	147.9	40.2
September .....	1110	65.44	370.1	157.5	24.6	120.7	43.2
October .....	1144	17.44	238.5	102.0	8.5	120.3	21.1

BETSEY 10TH — SHORTHORN.  
Second Period — Calves November 25, 1893.

TABLE 23.

MONTH.	Weight.	Albuminoids	Nitrogen free extract.	Starch and sugars.	Crude fat.	Fiber.	Ash.
1893.							
November.....	1233	4.91	30.8	15.6	2.3	13.6	5.1
December.....	1066	51.19	355.8	178.9	25.6	142.6	33.9
1894.							
January.....	1087	70.31	388.8	237.0	28.9	142.4	37.0
February.....	1077	76.87	330.7	169.0	32.2	129.0	35.2
March.....	1110	85.31	389.9	209.2	38.0	141.3	41.0
April.....	1 06	68.31	374.1	210.8	26.9	138.6	37.9
May.....	1117	90.31	345.8	172.4	31.0	135.7	47.2
June.....	1063	82.44	392.3	179.8	30.3	169.9	48.1
July.....	1103	89.75	478.7	203.0	32.6	203.6	46.8
August.....	1094	69.56	434.2	90.5	45.8	140.5	39.0
September.....	1099	79.44	409.1	132.1	28.6	125.3	46.0
October.....	1132	75.25	347.4	155.0	25.1	163.9	39.2

LADY SPENCER — SHORTHORN.  
 Second Period — Calved February 2, 1894.

TABLE 23.

MONTH.	Weight.	Albuminoids.	Nitrogen free extract.	Starch and sugars.	Crude fat.	Fiber.	Ash.
1894.							
February .....	1503	51.31	250.1	143.4	20.3	96.5	28.7
March .....	1345	85.56	399.3	215.2	38.3	145.6	42.1
April .....	1338	75.56	418.0	235.2	30.0	153.7	42.3
May .....	1349	103.56	394.3	195.2	35.6	154.1	54.4
June .....	1258	91.19	434.2	199.7	33.5	190.1	53.4
July .....	1330	100.44	536.5	225.8	36.3	210.4	53.0
August .....	1292	74.25	469.2	97.4	49.4	154.5	42.5
September .....	1277	83.62	457.3	201.6	32.3	139.3	51.5
October .....	1317	90.06	409.3	186.3	29.9	185.4	45.2

ALBERT'S CAROL — JERSEY.  
Second Period — Calved October 31, 1893.

TABLE 24.

MONTH	Weight.	Albuminoids.	Nitrogen free extract.	Starch and sugars.	Crude fat.	Fibr.	Ash.
1893.							
November.....	880	35.60	226.5	125.9	15.8	74.7	27.8
December.....	754	45.37	311.2	158.1	23.6	122.0	29.3
1894.							
January.....	797	60.50	326.5	203.7	25.0	116.3	30.5
February.....	800	69.25	286.1	150.2	29.1	109.6	30.3
March.....	846	63.81	311.9	165.2	33.6	110.3	32.5
April.....	844	61.19	313.9	173.8	23.6	109.2	30.9
May.....	876	84.81	313.7	163.1	29.1	116.5	41.6
June.....	867	65.37	316.2	145.2	24.2	128.1	37.1
July.....	854	64.44	349.7	150.4	23.5	124.4	32.6
August.....	871	52.00	315.4	62.1	33.5	96.8	27.7
September.....	895	42.06	247.8	108.8	15.9	85.2	29.8

NETHERLAND CONSTANCE — HOLSTEIN-FRIESIAN.  
*Second Period — Calved June 24, 1894.*

TABLE 25.

MONTH	Milk prod., pounds.	Per cent. solids	Per cent. fat.	Per cent. casein	Per cent. sugar.	Per cent. ash.	Pounds solids.	Pounds fat.	Pounds casein.	Pounds sugar.	Pounds ash.
1894.											
June.....	146.3	12.85	4.40	2.98	4.80	0.67	18.8	6.4	4.4	7.0	1.0
July.....	1247.3	11.00	2.92	2.69	4.79	0.60	137.2	36.5	33.5	59.7	7.5
August.....	1152.4	10.41	2.56	2.51	4.75	0.59	119.9	29.5	28.9	54.7	6.8
September..	1133.2	10.43	2.45	2.53	4.87	0.58	118.2	27.8	28.7	55.2	6.5
October.....	972.9	10.52	2.47	2.64	4.81	0.60	102.3	24.0	25.7	46.8	5.8

BEAUTY PLEDGE—HOLSTEIN-FRIESIAN.  
Second Period 1—Calved December 10, 1893.

TABLE 26.

MONTH.	Milk yield, pounds.	Per cent solids.	Per cent. fat.	Per cent. casein.	Per cent. sugar.	Per cent. ash.	Pounds solids.	Pounds fat.	Pounds case-in.	Pounds sugar.	Pounds ash.
1893. December ..	695.7	13.20	4.20	3.02	5.31	0.67	91.8	29.2	21.0	36.9	4.7
1894. January .....	1197.4	12.61	4.14	2.74	5.13	0.60	151.0	49.6	32.8	61.4	7.2
February .....	1219.0	11.79	3.76	2.45	4.97	0.61	143.7	45.8	29.9	60.6	7.4
March .....	1364.5	11.73	3.70	2.56	4.90	0.57	160.1	50.7	34.9	66.8	7.7
April .....	1135.8	11.57	3.43	2.56	4.96	0.62	131.4	39.0	29.1	56.3	7.0
May .....	994.0	11.61	3.45	2.70	4.88	0.58	115.4	34.3	26.8	48.5	5.8
June .....	793.0	11.52	3.20	2.63	5.13	0.56	91.4	25.4	20.9	40.7	4.4
July .....	508.9	12.83	3.98	3.17	5.06	0.62	65.3	20.2	16.1	25.8	3.2
August .....	426.4	13.19	3.90	3.63	5.00	0.66	56.2	16.6	15.5	21.3	2.8
September ..	170.9	15.79	5.28	4.71	5.01	0.79	27.0	9.0	8.0	8.6	1.4
October .....	3.6	13.92	3.70	5.58	3.89	0.75	0.5	0.1	0.2	0.2	0.0

BETSEY 10TH — SHOETHORN.  
*Second Period — Calved November 25, 1893.*

TABLE 27.

MONTH.	Milk yield, pounds.	Per cent. solids.	Per cent. fat.	Per cent. casein.	Per cent. sugar.	Per cent. ash.	Pounds solids.	Pounds fat.	Pounds casein.	Pounds sugar.	Pounds ash.
1893.											
November ..	67.0	13.84	4.55	3.24	5.36	0.69	9.3	3.0	2.2	3.6	0.5
December ..	886.6	13.78	4.49	3.26	5.33	0.70	122.2	39.8	28.9	47.3	6.2
1894.											
January ....	941.1	13.91	4.62	3.33	5.38	0.68	130.9	43.5	30.4	50.6	6.4
February ...	782.9	14.18	4.53	3.51	5.37	0.77	111.0	35.5	27.5	42.0	6.0
March .....	826.6	14.44	4.63	3.70	5.43	0.68	119.4	38.3	30.6	44.9	5.6
April .....	693.0	14.55	4.72	3.82	5.28	0.73	100.8	32.7	26.5	36.6	5.0
May .....	652.2	14.51	4.75	3.71	5.36	0.69	94.6	31.0	24.2	34.9	4.5
June .....	584.2	14.73	4.45	3.68	5.48	0.72	83.7	26.0	21.5	32.0	4.3
July .....	597.9	14.20	4.50	3.72	5.25	0.73	84.9	26.9	22.2	31.4	4.4
August .....	596.6	14.28	4.55	3.67	5.33	0.73	85.2	27.1	21.9	31.8	4.4
September ..	530.0	14.30	4.27	3.86	5.41	0.76	75.8	22.6	20.5	28.7	4.0
October .....	328.5	15.23	4.45	4.20	5.75	0.83	50.0	14.6	13.8	18.9	2.7

LADY SPENCER — SHORTHORN.  
*Second Period — Calved February 2, 1894.*

TABLE 28.

MONTH.	Milk yield, pounds.	Per cent. solids.	Per cent. fat.	Per cent. casein.	Per cent. sugar.	Per cent. ash.	Pounds solids.	Pounds fat.	Pounds casein.	Pounds sugar.	Pounds ash.
1894.											
February ...	768.6	14.34	5.54	3.11	5.05	0.64	110.2	42.6	23.9	38.8	4.9
March .....	1093.8	13.00	4.35	2.90	5.15	0.60	142.2	47.6	31.7	56.3	6.6
April .....	959.4	13.85	4.72	3.31	5.20	0.62	132.9	45.3	31.8	49.9	5.9
May .....	880.9	12.85	3.95	3.08	5.20	0.62	113.2	34.8	27.1	45.8	5.5
June .....	748.7	12.60	3.72	3.16	5.10	0.62	94.3	27.9	23.6	38.2	4.6
July .....	670.3	13.02	3.80	3.30	5.29	0.63	87.3	25.5	22.1	35.5	4.2
August .....	668.8	13.07	4.08	3.41	4.95	0.63	87.4	27.3	22.8	33.1	4.2
September ..	587.5	12.91	3.85	3.46	4.95	0.65	75.8	22.6	20.3	29.1	3.8
October ...	497.7	13.20	4.13	3.57	4.87	0.63	65.7	20.6	17.8	24.2	3.1

ALBERT'S CAROL - JERSEY.  
*Second Period - Calved October 31, 1893.*

TABLE 29.

MONTH.	Milk yield, pounds.	Per cent. solids.	Per cent. fat.	Per cent. casein.	Per cent. sugar.	Per cent. ash.	Pounds solids.	Pounds fat.	Pounds casein.	Pounds sugar.	Pounds ash.
1893.											
November ..	422.3	14.66	5.29	3.48	5.25	0.64	61.9	22.3	14.7	22.2	2.7
December ..	538.1	15.61	6.13	3.35	5.47	0.66	84.0	33.0	18.0	29.4	3.6
1894.											
January ....	565.0	15.63	5.97	3.68	5.31	0.67	88.3	33.7	20.8	30.0	3.8
February ...	505.7	15.61	6.08	3.62	5.18	0.73	78.9	30.7	18.3	26.2	3.7
March .. .	538.4	15.67	6.18	3.67	5.19	0.63	84.4	33.3	19.8	27.9	3.4
April .....	468.1	15.77	6.15	3.76	5.19	0.67	73.8	28.8	17.6	24.3	3.1
May .....	478.3	15.72	5.75	3.68	5.59	0.70	75.2	27.5	17.6	26.7	3.4
June .....	369.5	15.83	5.35	4.16	5.61	0.71	58.5	19.8	15.4	20.7	2.6
July .....	315.7	16.16	5.82	4.22	5.41	0.71	51.0	18.4	13.3	17.1	2.2
August .....	184.8	15.76	5.18	4.81	5.03	0.74	29.1	9.6	8.9	9.3	1.3
September ..	33.3	15.22	5.65	4.81	4.13	0.63	5.1	1.9	1.6	1.4	0.2

ORIOLE—GUERNSEY.  
 Third Period — Calved February 25, 1894.

TABLE 30.

MONTH.	Weight.	Albuminoids.	Nitrogen free extract.	Starch and sugars.	(crude fat.	Fiber.	Ash.
1894.							
February.....	1031	3.94	20.6	11.3	1.6	9.1	2.5
March.....	884	57.25	293.5	162.3	25.8	112.0	31.4
April.....	843	61.06	247.8	197.1	24.5	131.2	35.6
May.....	836	90.81	345.3	171.2	31.2	135.1	47.5
June.....	802	82.50	392.9	180.1	30.4	170.3	48.2
July.....	833	94.12	502.5	212.8	34.1	194.7	49.3
August.....	854	66.44	423.4	81.7	44.4	141.8	38.6
September.....	839	82.69	418.7	186.1	29.6	129.4	48.0
October.....	840	80.62	348.8	161.4	26.4	153.5	39.2

## STELLA SELECT — GUERNSEY.

## Third Period — Calved June 7, 1894.

TABLE 31.

MONTH.	Weight.	Albuminoids.	Nitrogen free extract.	Starch and sugars.	Crude fat.	Fiber.	Ash.
1894.							
June.....	901	47.00	225.3	104.8	17.2	110.4	30.5
July.....	783	85.37	448.9	187.9	30.8	186.6	46.2
August .....	795	61.31	399.3	76.0	41.5	140.5	37.2
September.....	783	67.81	349.7	151.2	24.4	117.8	43.4

ARTALIA — DEVON.  
Third Period — Calved March 17, 1894.

TABLE 32.

MONTH.	Weight.	Albuminoids.	Nitrogen free extract.	Starch and sugars.	Crude fat.	Fiber.	Ash.
1894.							
March .....	1170	11.37	91.3	54.8	5.3	40.9	10.2
April .....	1041	33.56	234.6	139.8	14.0	105.8	25.9
May .....	1055	61.75	235.1	116.5	20.9	103.4	36.0
June .....	1031	63.87	288.1	126.2	23.5	141.7	39.5
July .....	1089	71.50	374.4	157.2	25.9	156.9	38.8
August .....	1091	50.50	351.4	69.9	36.6	121.9	32.2
September .....	1121	62.31	331.6	86.4	22.7	107.2	38.6
October .....	1127	55.81	256.3	110.8	18.6	124.0	30.3

ORIOLE — GUERNSEY.  
*Third Period — Calved February 25, 1894.*

TABLE 33.

MONTH.	Milk yield, pounds.	Per cent. solids.	Per cent. fat.	Per cent. casein.	Per cent. sugar.	Per cent. ash.	Pounds solids.	Pounds fat.	Pounds casein.	Pounds sugar.	Pounds ash.
1894.											
February ...	46.7	13.95	5.00	3.43	4.80	0.72	6.5	2.3	1.6	2.3	0.3
March .....	991.9	13.49	4.68	3.07	5.07	0.67	133.8	46.4	30.5	50.3	6.6
April .....	923.0	13.24	4.56	2.89	5.15	0.64	122.2	42.1	26.7	47.5	5.9
May .....	872.4	13.68	4.70	3.05	5.31	0.62	119.3	41.0	26.6	46.3	5.4
June .....	747.6	13.20	4.20	3.10	5.26	0.64	98.7	31.4	23.2	39.3	4.8
July .....	779.0	14.09	4.88	3.29	5.30	0.62	109.7	38.0	25.6	41.3	4.8
August .....	730.3	14.06	4.65	3.51	5.25	0.65	102.6	34.0	25.6	38.3	4.7
September ..	653.8	14.26	5.20	3.39	5.00	0.67	93.2	34.0	22.1	32.7	4.4
October .....	573.5	14.83	5.57	3.56	5.04	0.66	85.0	31.9	20.4	28.9	3.8

## STELLA SELECT — GUERNSEY.

*Third Period — Calved June 7, 1894.*

TABLE 34.

MONTH.	Milk yield, pounds.	Per cent. solids.	Per cent. fat.	Per cent. casein.	Per cent. sugar.	Per cent. ash.	Pounds solids.	Pounds fat.	Pounds casein.	Pounds sugar.	Pounds ash.
1894.											
June .....	387.8	13.07	3.85	3.46	5.09	0.67	50.6	14.9	13.4	19.7	2.6
July .....	596.9	13.17	4.15	3.20	5.20	0.62	78.6	24.8	19.1	31.0	3.7
August ....	534.4	14.32	5.10	3.31	5.30	0.61	76.5	27.3	17.7	28.3	3.2
September ..	428.0	14.84	5.50	3.53	5.27	0.54	63.5	23.5	15.1	22.6	2.3

AETALIA — DEVON.  
Third Period — Calved March 17, 1894.

TABLE 35.

MONTH.	Milk yield, pounds.	Per cent. solids.	Per cent. fat.	Per cent. casein.	Per cent. sugar.	Per cent. ash.	Pounds solids.	Pounds fat.	Pounds casein.	Pounds sugar.	Pounds ash.
1894.											
March .....	154.6	15.01	4.97	4.19	5.16	0.69	23.2	7.7	6.5	8.0	1.0
April .....	331.9	14.00	4.45	3.80	5.07	0.68	46.5	14.8	12.6	16.8	2.3
May .....	311.1	14.02	4.55	3.84	5.01	0.62	46.4	15.1	12.7	16.6	2.0
June .....	266.2	14.06	4.40	4.18	4.80	0.68	37.4	11.7	11.1	12.8	1.8
July .....	211.6	13.92	4.60	4.07	4.59	0.66	29.4	9.7	8.6	9.7	1.4
August .....	188.2	14.17	4.55	4.46	4.48	0.68	26.7	8.6	8.4	8.4	1.3
September ..	144.0	13.65	3.95	4.30	4.68	0.72	19.6	5.7	6.2	6.7	1.0
October ..	121.3	14.36	4.40	4.27	4.98	0.71	17.4	5.3	5.2	6.0	0.9

COUNTRESS FLAVIA — JERSEY.  
 Fourth Period — Calved November 4, 1893.

TABLE 36.

MONTH.	Weight.	Albuminoids.	Nitrogen free extract.	Starch and sugars.	Crude fat.	Fiber.	Ash.
1893.							
November.....	896	39.44	369.5	140.4	18.8	103.9	30.0
December.....	783	51.94	358.1	182.1	25.9	139.6	33.7
1894.							
January.....	827	64.69	358.6	218.7	26.5	132.4	34.3
February.....	813	72.56	311.3	161.6	30.3	122.4	33.3
March.....	837	79.44	364.8	195.9	35.7	130.6	38.3
April.....	860	65.50	351.3	195.8	25.8	124.8	35.1
May.....	838	88.50	333.7	164.0	30.5	125.7	45.3
June.....	855	67.62	324.5	147.7	25.0	132.5	38.5
July.....	774	68.69	353.6	128.0	24.6	143.3	36.7
August.....	861	46.31	342.9	64.1	32.3	117.3	31.2
September.....	871	47.00	270.1	115.4	17.5	94.1	33.5
October.....	864	13.94	182.9	83.1	6.6	93.9	17.1

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BARBARA ALLEN — JERSEY.  
Fourth Period — Calved April 17, 1894.

TABLE 37.

MONTH.	Weight.	Albuminoids.	Nitrogen free extract.	Starch and sugars.	Crude fat.	Fiber.	Ash.
1894.							
April .....	981	20.87	123.0	73.8	7.7	52.3	14.0
May .....	916	91.12	344.3	170.1	31.2	135.0	47.8
June .....	876	83.12	395.7	181.2	30.6	171.9	48.6
July .....	894	96.12	515.1	217.8	34.8	198.6	50.4
August .....	984	70.37	441.0	85.7	46.5	141.7	39.5
September .....	899	84.37	430.3	191.6	30.3	133.2	49.2
October .....	930	80.75	361.6	167.3	26.7	160.9	39.7

JUNIETTA PEERLESS — AYRSHIRE.  
*Fourth Period—Calved May 30, 1894.*

TABLE 38.

MONTH.	Weight.	Albuminoids.	Nitrogen free extract.	Starch and sugars.	Crude fat.	Fiber.	Ash.
1894.							
May.....	1085	0.86	6.3	2.6	0.4	3.2	0.9
June.....	1086	70.75	339.5	157.3	26.1	148.5	42.8
July.....	898	91.62	489.4	208.8	33.3	186.6	47.7
August.....	916	75.37	461.0	97.0	48.6	149.8	41.7
September.....	890	89.56	448.2	197.7	32.0	133.8	49.9
October.....	917	89.56	382.4	180.3	28.8	168.1	42.9

TABLE 39.

MANTON BELLE — AYESHIRE.

*Fourth Period — Calved December 13, 1893.*

MONTH.	Weight	Albuminoids.	Nitrogen free extract.	Starch and sugars.	Crude fat.	Fiber.	Ash.
1893.							
December .....	1201	31.00	202.1	102.7	15.1	83.3	19.9
1894.							
January .....	1077	54.25	297.0	175.7	30.7	122.5	29.4
February .....	1002	74.77	330.6	165.7	30.9	134.0	35.6
March .....	1018	76.06	372.2	203.3	34.1	139.7	39.6
April .....	1031	65.50	378.0	215.9	26.1	146.9	39.1
May .....	1053	95.37	364.8	182.1	32.6	146.0	50.6
June .....	1010	89.87	426.0	195.2	38.0	189.7	53.2
July .....	1088	92.62	489.2	204.0	33.4	202.4	50.1
August .....	1076	68.31	437.8	88.3	45.1	145.5	39.6
September .....	1078	85.31	436.6	193.0	30.7	134.3	49.7
October .....	1146	49.50	254.8	100.8	17.0	139.2	30.4

TABLE 40.

MISS FLOW 5TH — AYRESHIRE.

Fourth Period — Calved April 20, 1893.

MONTH.	Weight.	Albuminoids.	Nitrogen free extract.	Starch and sugars.	Crude fat.	Fiber.	Ash.
1893.							
April .....	1105	15.12	83.7	62.7	7.3	33.1	10.1
May .....	937	52.12	289.3	222.9	29.5	98.0	25.5
June .....	886	82.44	319.4	224.1	34.2	147.8	42.4
July .....	936	92.56	348.7	246.3	36.5	161.9	47.9
August .....	964	89.44	361.5	214.5	47.0	170.8	44.7
September .....	960	93.56	446.6	275.9	51.9	163.3	40.2
October .....	996	82.00	437.1	258.3	43.3	130.4	47.5
November .....	977	62.88	381.4	198.9	31.0	140.6	36.4
December .....	1044	61.94	390.9	205.4	30.0	145.1	35.6
1894.							
January .....	1092	64.31	353.3	215.7	26.1	132.3	33.8
February .....	1124	58.06	268.8	140.6	23.9	112.6	29.1

MAGGIE 6TH — AMERICAN HOLDERNESS.  
*Fourth Period — Calved May 11, 1894.*

TABLE 41.

MONTH.	Weight.	Albuminoids.	Nitrogen free extract.	Starch and sugars.	Crude fat.	Fiber.	Ash.
1894.							
May .....	1130	48.37	167.5	80.6	15.8	66.7	27.2
June .....	911	66.00	311.0	136.4	24.7	124.6	37.4
July .....	865	74.56	398.4	174.3	27.3	142.7	37.6
August .....	869	62.37	370.8	79.6	39.4	15.1	32.9
September .....	858	76.44	363.5	169.0	27.3	110.3	41.4
October .....	880	76.40	316.4	149.4	24.7	133.6	35.6

COUNTRESS FLAVIA — JERSEY.  
Fourth Period — Calved November 4, 1893.

TABLE 42.

MONTH	Milk yield, pounds.	Per cent. solids.	Per cent. fat.	Per cent. casein.	Per cent. sugar.	Per cent. ash.	Pounds solids.	Pounds fat.	Pounds casein.	Pounds sugar.	Pounds ash.
1893.											
November ..	512.2	15.08	5.37	3.87	5.16	0.68	77.2	27.5	19.8	26.4	3.5
December ..	731.8	15.36	5.72	3.65	5.31	0.68	112.4	41.9	26.7	38.8	5.0
1894.											
January ....	698.9	16.38	6.30	3.88	5.40	0.70	113.7	44.0	27.1	37.7	4.9
February ...	625.6	15.74	6.10	3.84	5.09	0.71	98.4	38.2	24.0	31.8	4.4
March .....	693.6	15.87	6.25	3.83	5.15	0.64	110.1	43.4	26.6	35.7	4.4
April .....	595.2	15.35	6.00	3.65	5.03	0.67	91.3	35.7	21.7	29.9	4.0
May .....	572.5	16.48	6.73	3.79	5.29	0.67	94.3	38.5	21.7	30.3	3.8
June .....	433.5	16.41	6.47	3.77	5.49	0.69	71.1	28.0	16.3	23.8	3.0
July .....	413.0	15.74	5.77	3.79	5.50	0.68	65.0	23.8	15.7	22.7	2.8
August .....	381.2	15.47	5.65	3.80	5.35	0.67	59.0	21.5	14.5	20.4	2.6
September ..	241.1	17.20	6.72	4.22	5.48	0.78	41.5	16.2	10.2	13.2	1.9
October ....	28.4	15.37	6.80	4.93	2.90	0.74	4.3	1.8	1.4	0.9	0.2

BARBARA ALLEN — JERSEY.  
Fourth Period — Calved April 17, 1894.

TABLE 43.

MONTH.	Milk yield, p. unda.	Per cent. solids.	Per cent. fat.	Per cent. casein.	Per cent. sugar.	Per cent. ash.	Pounds solids.	Pounds fat.	Pounds casein.	Pounds sugar.	Pounds ash.
1894.											
April .....	161.7	14.92	5.00	3.93	5.31	0.68	24.1	8.1	6.3	8.6	1.1
May .....	728.1	14.11	4.86	3.41	5.19	0.65	102.7	35.4	24.8	37.8	4.7
June .....	680.8	14.02	4.69	3.42	5.27	0.64	95.4	31.9	23.3	35.9	4.3
July .....	690.2	14.47	5.25	3.44	5.15	0.63	99.8	36.2	23.7	35.6	4.3
August .....	689.1	15.08	5.43	3.65	5.35	0.65	103.9	37.4	25.1	36.9	4.5
September..	635.4	15.00	5.42	3.67	5.25	0.66	95.3	34.4	23.3	33.4	4.2
October .....	527.1	15.20	5.57	3.72	5.24	0.67	80.1	29.4	19.6	27.6	3.5

JUNIETTA PEERLESS — AYRSHIRE.  
*Fourth Period — Calved May 30, 1894.*

TABLE 44.

MONTH.	Milk yield, pounds.	Per cent. solids.	Per cent. fat.	Per cent. casein.	Per cent. sugar.	Per cent. ash.	Pounds solids.	Pounds fat.	Pounds casein.	Pounds sugar.	Pounds ash.
1894.											
May .....	24.9	15.54	5.80	4.04	5.06	0.64	3.9	1.4	1.0	1.3	0.2
June .....	955.5	12.99	4.12	3.02	5.27	0.58	124.1	39.4	28.9	50.3	5.5
July .....	1066.4	11.27	2.99	2.51	5.22	0.55	120.2	31.9	26.7	55.8	5.8
August .....	1069.8	11.25	3.07	2.57	5.09	0.52	120.4	32.8	27.5	54.5	5.6
September ..	1013.4	11.82	3.05	2.79	5.39	0.59	119.8	30.9	28.3	54.6	6.0
October .....	866.7	11.94	3.20	2.90	5.27	0.57	103.4	27.7	25.1	45.7	4.7

MANTON BELLE — AYESHIRE.  
*Fourth Period — Calved December 12, 1893.*

TABLE 45.

MONTH.	Milk yield, pounds.	Per cent. solids.	Per cent. fat.	Per cent. casein.	Per cent. sugar.	Per cent. ash.	Pounds solids.	Pounds fat.	Pounds casein.	Pounds sugar.	Pounds ash.
1893.											
December ..	622.5	13.09	3.95	3.38	5.15	0.61	81.5	24.6	21.0	32.1	3.8
1894.											
January ....	844.1	12.28	3.71	2.87	5.15	0.55	103.6	31.3	24.2	43.5	4.6
February ....	946.0	11.76	3.58	2.49	5.14	0.55	111.2	33.9	23.5	48.6	5.2
March .....	1058.9	11.75	3.15	2.76	5.28	0.56	124.4	33.4	29.2	55.9	5.9
April .....	841.4	11.66	3.22	2.80	5.06	0.58	98.1	27.1	23.5	42.6	4.9
May .....	830.8	11.89	3.35	2.86	5.14	0.54	98.8	27.8	23.8	42.7	4.5
June .....	728.8	11.94	3.55	2.82	5.02	0.55	86.4	25.7	20.4	36.3	4.0
July .....	701.3	11.82	3.12	2.90	5.23	0.57	82.9	21.9	20.3	36.7	4.0
August .....	562.2	12.28	3.55	3.16	4.98	0.59	69.0	19.9	17.8	28.0	3.3
September...	429.9	12.34	3.58	3.22	4.93	0.61	53.0	15.4	13.8	21.2	2.6
October .....	104.8	13.07	3.80	3.60	4.96	0.71	13.7	4.0	3.8	5.2	0.7

MISS FLOW 5TH — AYRESHIRE.  
Fourth Period — Calved April 20, 1893.

TABLE 46.

MONTH.	Milk yield, pounds.	Per cent. solids.	Per cent. fat.	Per cent. casein.	Per cent. sugar.	Per cent. ash.	Pounds solids.	Pounds fat.	Pounds casein.	Pounds sugar.	Pounds ash.
1893.											
April .....	205.3	12.66	3.76	2.91	5.41	0.58	26.0	7.7	6.0	11.1	1.2
May .....	910.5	12.79	3.77	3.00	5.43	0.59	116.4	34.3	27.3	49.4	5.4
June .....	814.9	12.54	3.75	2.82	5.40	0.57	102.2	30.6	23.0	44.0	4.6
July .....	798.4	12.65	3.92	3.08	5.08	0.57	101.0	31.3	24.6	40.6	4.5
August .....	754.0	12.50	3.52	3.00	5.36	0.62	94.2	26.5	22.6	40.4	4.7
September ..	730.0	12.64	3.70	3.09	5.27	0.58	91.0	26.7	22.2	37.9	4.2
October .....	671.8	13.32	4.09	3.57	5.05	0.61	89.5	27.5	24.0	33.9	4.1
November ..	570.4	13.54	4.10	3.66	5.12	0.66	77.2	23.4	20.9	29.2	3.7
December ..	490.6	13.57	4.15	3.77	5.02	0.63	66.6	20.4	18.5	24.6	3.1
1894.											
January .....	290.3	14.05	4.40	4.03	4.94	0.68	40.8	12.8	11.7	14.3	2.0
February ...	64.0	14.61	4.68	5.05	4.05	0.83	9.3	3.0	3.2	2.6	0.5

MAGGIE 6TH — AMERICAN HOLDERNESS.  
*Fourth Period — Calved May 11, 1894.*

TABLE 47.

MONTH.	Milk yield, pounds.	Per cent. solids.	Per cent. fat.	Per cent. casein.	Per cent. sugar.	Per cent. ash.	Pounds solids.	Pounds fat.	Pounds casein.	Pounds sugar.	Pounds ash.
1894.											
May .....	500.1	15.06	5.35	3.94	5.04	0.73	75.3	26.7	19.7	25.2	3.7
June .....	953.7	12.02	3.64	2.73	5.03	0.62	114.6	34.7	26.0	48.0	5.9
July .....	911.4	11.64	3.18	2.63	5.20	0.63	106.1	29.0	24.0	47.4	5.7
August .....	808.7	11.98	3.45	2.67	5.28	0.58	96.9	27.9	21.6	42.7	4.7
September ..	721.9	12.33	3.40	2.88	5.39	0.66	89.0	24.5	20.8	38.9	4.8
October .....	588.7	12.61	3.72	3.16	5.08	0.65	74.2	21.9	18.6	29.9	3.8

MISS FLOW 5TH — AYRESHIRE.  
Fifth Period — Calved May 12, 1894.

TABLE 48.

MONTH.	Weight.	Albuminoids.	Nitrogen free extract.	Starch and sugars.	Crude fat.	Fiber.	Ash.
1894.							
May .....	1115	48.69	171.2	84.7	15.8	70.6	27.2
June .....	956	82.00	386.6	173.8	30.3	166.2	47.8
July .....	997	94.06	502.4	216.3	34.3	188.0	48.5
August .....	997	71.31	437.1	92.6	46.1	138.0	38.9
September .....	957	86.13	436.6	193.6	30.9	130.9	48.7
October .....	982	85.87	373.3	172.3	28.1	163.9	41.6

MISS FLOW 5TH — AYESHIRE.  
Fifth Period — Calved May 12, 1894.

TABLE 49.

MONTH.	Milk yield, pounds.	Per cent. -solids.	Per cent. fat.	Per cent. casein.	Per cent. sugar.	Per cent. ash.	Pounds solids.	Pounds fat.	Pounds casein.	Pounds sugar.	Pounds ash.
1894.											
May .....	454.7	13.63	4.55	3.01	5.47	0.59	61.9	20.7	13.7	24.9	2.6
June .....	954.3	12.33	3.39	2.90	5.44	0.60	117.7	32.4	27.7	51.9	5.7
July .....	967.7	12.48	3.55	2.90	5.42	0.61	120.8	34.4	28.1	52.4	5.9
August .....	931.1	12.19	3.20	3.17	5.15	0.67	113.5	29.8	29.5	48.0	6.2
September ..	797.1	12.96	3.83	3.21	5.26	0.66	103.3	30.5	25.6	41.9	5.3
October .....	708.1	13.44	4.15	3.28	5.37	0.64	95.1	29.4	23.2	38.0	4.5

TABLE 50. COST OF PRODUCTION OF MILK AND FAT—FIRST PERIOD OF LACTATION.

Breed.	NAME OF ANIMAL.	Total cost.	Number of days.	Average cost per day.	Total milk yield.	Total fat yield.	Average cost of milk per pound.	Average cost of fat per pound.
				Cents.	Pounds.	Pounds.	Cents.	Cents.
Holstein-Friesian	Eel 2d.....	\$127 53	761	16.76	13767.0	435.7	.935	39.3
Holstein-Friesian	Beauty Pledge.....	86 75	581	14.93	9361.3	310.7	.927	37.9
Holstein-Friesian	Netherland Constance.....	98 25	581	16.91	13874.9	430.0	.703	32.4
Holstein-Friesian	Ruth.....	45 01	286	13.81	6344.0	184.3	.709	34.4
	Average.....			15.60			.816	36.2
Ayrshire.....	M's Flow 5th.....	\$55 81	161	15.46	5351.3	322.8	1.032	24.8
Ayrshire.....	Queen Duchess.....	71 97	485	14.94	9490.1	367.9	.768	19.6
Ayrshire.....	Manton Belle.....	52 68	379	13.90	6796.8	230.4	.775	22.9
Ayrshire.....	Junietta Peerless.....	53 57	461	11.63	5753.3	179.5	.931	39.8
	Average.....			14.06			.879	24.3
Jersey.....	Gliderbloom.....	\$69 64	132	13.19	5319.1	333.0	1.109	28.8
Jersey.....	Countess Flavia.....	53 59	539	14.79	8035.5	477.0	1.039	17.3
Jersey.....	Barbara Allen.....	53 01	510	13.61	7369.9	436.7	1.043	19.0
Jersey.....	Albert's Carol.....	73 06	537	13.60	7071.1	404.1	1.063	18.1
	Average.....			13.80			1.103	19.5
American Holderness.....	Nellie 6th.....	\$38 72	373	10.41	4173.5	145.5	.927	26.6
American Holderness.....	Magie 6th.....	57 41	463	12.43	6132.3	230.1	.923	33.1
American Holderness.....	* Nora.....	40 23	313	12.65	6133.0	229.5	.655	17.5
	Average.....			11.53			.837	23.4
Guernsey.....	Rosette Ford.....	\$39 75	670	13.40	8143.3	447.0	1.102	30.1
Guernsey.....	Orville.....	54 13	730	13.00	10377.3	577.8	.865	18.3
Guernsey.....	Madam Select.....	33 18	237	13.90	2349.3	133.7	.969	18.3
Guernsey.....	Stella Select.....	63 42	455	13.70	6550.5	330.8	.949	19.5
	Average.....			13.00			.976	18.5

## COST OF PRODUCTION OF MILK AND FAT — FIRST PERIOD OF LACTATION — (Continued).

Breed.	NAME OF ANIMAL.	Total cost.	Number of days.	Average cost per day.	Total milk yield.	Total fat yield.	Average cost of milk per pound.	Average cost of fat per pound.
				Cents.	Pounds.	Pounds.	Cents.	Cents.
Devon .....	Ione .....	\$53 73	451	11.91	6098.6	801.9	.809	26.6
Devon .....	Genevieve's Gift .....	40 07	443	9.05	3273.6	506.5	1.006	19.4
Devon .....	Artalia .....	68 76	493	13.95	6322.6	598.1	.991	25.6
Devon .....	Day Dream B. ....	38 59	361	10.85	2880.3	149.7	1.284	24.7
	Average .....			11.80			1.023	24.1
Shorthorn .....	Betsy 10th .....	\$75 73	514	14.73	6039.0	807.8	1.077	24.6
Shorthorn .....	Lady Spencer .....	73 88	448	16.49	4099.8	184.7	1.643	40.0
	Average .....			15.61			1.360	32.3
	Average of individuals .....			13.51			.977	23.4
	Average of breeds .....			13.00			.999	24.0

\* Calculated to November 1, 1894, only.

TABLE 51. COST OF PRODUCTION OF MILK AND FAT — SECOND PERIOD OF LACTATION.

Breed.	NAME OF ANIMAL.	Total cost	Number of days.	Average cost per day.	Total milk yield.	Total fat yield.	Average cost of milk per pound.	Average cost of fat per pound.
				Cents.	Pounds.	Pounds.	Cents.	Cents.
Holstein-Friesian.....	Eel 2d.....	\$75 88	396	19.15	7786.0	932.3	.974	26.9
Holstein-Friesian.....	Tolama Artia.....	65 17	388	16.80	8076.1	928.2	.807	28.5
Holstein-Friesian.....	Beauty Pledge.....	49 58	399	15.53	8602.2	319.9	.853	15.5
Holstein-Friesian.....	Netherland Countance*.....	18 41	199	14.27	4633.1	194.2	.306	14.8
	Average.....			16.70			.690	21.4
Ayrshire.....	Queen Duchess.....		335	16.25	7169.3	960.8	.780	30.9
Ayrshire.....	Manton Belle.....	50 80	304	16.71	6883.0	329.3	.812	22.2
Ayrshire.....	Junietta Peerless.....	55 16	383	14.66	7947.1	234.8	.751	23.5
Ayrshire.....	Miss Flow 5th.....	48 53	365	13.30	5319.3	185.4	.912	26.2
	Average.....			15.71			.806	23.2
Jersey.....	Gliderbloom.....		396	19.14	4733.5	257.4	1.003	18.7
Jersey.....	Countess Flavia.....	49 24	350	14.10	5307.7	295.6	.947	16.7
Jersey.....	Barbara Allen.....	53 60	365	14.68	5424.0	278.1	.866	19.3
Jersey.....	Albert's Carol.....	44 33	331	13.39	4419.3	269.0	1.001	17.1
	Average.....			13.68			.935	17.9
American Holderness.....	Margie 6th.....	\$48 57	318	15.27	6194.7	231.3	.793	21.0
American Holderness.....	Nellie 6th.....	41 95	323	12.99	4633.3	156.4	.905	27.0
	Average.....			14.13			.849	24.0
Guernsey.....	Rosette Ford.....	\$76 19	443	17.34	7238.6	494.0	1.053	18.0
Guernsey.....	Orion.....	63 01	406	15.53	7012.5	288.5	.890	16.2
Guernsey.....	Madam Select.....	53 77	353	15.00	6033.0	314.0	1.044	16.8
Guernsey.....	Stella Select.....	43 43	362	13.33	5745.1	296.6	.843	16.3
	Average.....			15.28			.960	16.8

## COST OF PRODUCTION OF MILK AND FAT—SECOND PERIOD OF LACTATION—(Continued).

Breed.	NAME OF ANIMAL.	Total cost.	Number of days.	Average cost per day.	Total milk yield.	Total fat yield.	Average cost of milk per pound.	Average cost of fat per pound.
Devon.	Ione .....	\$41 48	288	Cents. 14.40	Pounds. 3964.8	Pounds. 178.5	Cents. 1.049	Cents. 23.2
Devon.	Genevieve's Gift .....	38 64	300	12.88	4016.7	24.9	.562	18.9
Devon.	Artalia .....	38 80	284	14.70	3637.0	186.3	1.070	34.5
	Average .....			13.99			1.027	22.0
Shorthorn.	Betsy 10th* .....	\$33 22	310	15.65	7496.6	24.0	.711	15.6
Shorthorn.	Lady Spencer* .....	46 08	271	17.00	1856.7	294.2	.870	15.7
	Average .....			16.32			.600	15.7
	Average of individuals .....			15.13			.867	20.1
	Average of breeds .....			15.10			.868	20.1

\* Calculated to November 1, 1894, only.

TABLE 52. COST OF PRODUCTION OF MILK AND FAT — THIRD PERIOD OF LACTATION.

Breed.	NAME OF COW.	Total cost.	Number of days.	Average cost per day.	Total milk yield.	Total fat yield.	Average cost of milk per pound.	Average cost of fat per pound.
				Cents.	Pounds.	Pounds.	Cents.	Cents.
Holstein-Friesian.....	Tokma Artis.....	\$64 48	268	17.99	8560.9	266 9	.793	24.1
Ayrshire.....	Miss Flow 5th.....	\$51 82	315	16 45	6350.2	232.6	.818	23.3
Ayrshire.....	Manion Belle.....	65 94	353	18.33	8645.4	312.9	.754	20.8
Ayrshire.....	Junietta Peerless.....	59 73	360	16.59	9236.8	318.5	.647	18.8
	Average.....		.....	17.09	.....	.....	.740	21.0
Jersey.....	Gliderbloom.....	\$73 70	565	12 87	8 25.3	467.0	.894	15.9
Jersey.....	Countess Flavia.....	47 94	333	14 44	4730.3	369 8	1.016	16.5
Jersey.....	Barbara Allen.....	53 75	331	15.94	6194.0	353.4	.813	14.9
	Average.....		.....	14.43	.....	.....	.904	15.8
American Holderness.....	Maggie 8th.....	\$47 28	391	16.20	5993.4	231.5	.801	20.4
American Holderness.....	Nellie 6th.....	30 58	371	11.38	3369.8	115.8	.607	26.4
	Average.....		.....	13.76	.....	.....	.604	23.4
Guernsey.....	*Ortolo.....	\$46 50	348	14.73	6318.2	301.1	.578	12.1
Guernsey.....	*Stella Select.....	13 88	113	11.79	1947.1	90.5	.684	14.7
	Average.....		.....	13.26	.....	.....	.631	13.4
Devon.....	*Ione.....	\$33 90	167	13.89	*530.2	162.0	.663	14.3
Devon.....	*Artalia.....	22 74	228	9.97	1748.9	78.6	1.800	28.9
	Average.....		.....	11.93	.....	.....	.979	21.6
	Average of individuals.....		.....	14.61	.....	.....	.793	19.3
	Average of breeds.....		.....	14.74	.....	.....	.785	19.9

† Calculated to November 1, 1894, only. \* Died before completion of period.

TABLE 53. COST OF PRODUCTION OF MILK AND FAT—FOURTH PERIOD OF LACTATION.

Breed.	NAME OF COW.	Total cost.	Number of days.	Average cost per day.	Total milk yield.	Total fat yield.	Average cost of milk per pound.	Average cost of fat per pound.
Ayrshire	*Junetta Peerless	\$23 04	154	14.96	4906.7	164.1	.461	14.0
	Manton Belle	48 73	317	15.37	7065.7	265.0	.636	18.4
	Miss Fow 6th.	53 74	314	16.80	6992.4	244.2	.838	21.6
	Average	.....	.....	15.71	.....	.....	.645	18.0
Jersey	Countess Flavia.	\$47 96	348	13.78	5927.0	360.5	.809	13.3
	*Barbara Allen	39 48	197	14.96	4912.4	312.8	.700	13.9
American Holderness	Average	.....	.....	14.87	.....	.....	.754	13.6
	*Maggie 6th	\$31 95	174	12.61	4484.5	164.7	.489	13.3
	Average of individuals	.....	.....	14.75	.....	.....	.665	15.7
	Average of breeds	.....	.....	14.38	.....	.....	.699	15.0

\* Calculated to November 1, 1894, only.

TABLE 54.  
AVERAGE YIELD OF MILK AND PER CENT. OF FAT, EACH COW, EACH MONTH OF EACH PERIOD OF LACTATION.

Breed.	NAME OF COW.	FIRST PERIOD.		SECOND PERIOD.		THIRD PERIOD.		FOURTH PERIOD.		FIFTH PERIOD.	
		Milk yield.	Per cent. fat.	Milk yield.	Per cent. fat.	Milk yield.	Per cent. fat.	Milk yield.	Per cent. fat.	Milk yield.	Per cent. fat.
American Holderness.	Nellie 6th.....	379.4	3.536	451.6	3.459	391.0	3.693	.....	.....	.....	.....
American Holderness.	Maggie 6th.....	409.5	3.718	598.5	4.066	667.8	4.344	881.6	3.906	.....	.....
	Average.....	394.5	3.622	590.1	3.763	529.4	3.969	881.6	3.906	.....	.....
Guernsey.....	Rosette Ford.....	438.0	5.415	497.1	6.319	.....	.....	.....	.....	.....	.....
Guernsey.....	Orfiole.....	561.8	5.336	899.9	5.707	935.5	4.867	.....	.....	.....	.....
Guernsey.....	Madam Select.....	373.3	5.484	485.2	6.943	.....	.....	.....	.....	.....	.....
Guernsey.....	Stella Select.....	468.9	5.147	663.8	5.553	399.5	4.867	.....	.....	.....	.....
	Average.....	459.8	5.318	531.5	5.988	612.5	4.517	.....	.....	.....	.....
Holstein-Friesian.....	Ezel 2d.....	684.9	3.691	697.1	3.709	.....	.....	.....	.....	.....	.....
Holstein-Friesian.....	Tolama Artis.....	599.3	3.467	746.3	2.934	759.9	3.117	.....	.....	.....	.....
Holstein-Friesian.....	Beauty Pledge.....	580.2	3.373	964.3	3.751	.....	.....	.....	.....	.....	.....
	Average.....	618.1	3.441	765.9	3.466	769.9	3.217	.....	.....	.....	.....
Devon.....	Lone.....	385.4	4.550	448.7	4.782	647.9	5.066	.....	.....	.....	.....
Devon.....	Genevieve's Gift.....	392.9	5.108	430.3	5.419	.....	.....	.....	.....	.....	.....
Devon.....	Aralla.....	594.8	4.379	433.4	4.460	271.4	4.587	.....	.....	.....	.....
	Average.....	387.0	4.679	430.8	4.880	459.7	4.881	.....	.....	.....	.....
Ayrshire.....	Queen Duchess.....	635.4	3.906	699.4	3.766	.....	.....	.....	.....	.....	.....
Ayrshire.....	Junetta Peeries.....	596.7	3.377	698.8	3.416	779.8	3.683	1001.1	4.466	.....	.....
Ayrshire.....	Manon Belle.....	595.5	3.463	647.4	3.589	737.1	3.629	823.9	3.464	.....	.....
Ayrshire.....	Miss Flow 5th.....	476.7	4.403	466.6	3.648	646.3	3.764	694.9	3.985	902.3	3.673
	Average.....	515.8	3.515	623.1	3.602	730.7	3.659	616.3	3.951	902.3	3.673

## AVERAGE YIELD OF MILK AND PER CENT. OF FAT, ETC. — (Concluded.)

Breed.	NAME OF COW.	FIRST PERIOD.		SECOND PERIOD.		THIRD PERIOD.		FOURTH PERIOD.		FIFTH PERIOD.	
		Milk yield.	Per cent. fat.	Milk yield.	Per cent. fat.	Milk yield.	Per cent. fat.	Milk yield.	Per cent. fat.	Milk yield.	Per cent. fat.
Shorthorn.....	Betty 10th.....	507.9	4.371	715.7	4.579	.....	.....	.....	.....	.....	.....
	Lady Spencer.....	310.6	4.388	897.2	4.309	.....	.....	.....	.....	.....	.....
Jersey.....	Average.....	409.3	4.328	771.5	4.444	.....	.....	.....	.....	.....	.....
	G'derbloom.....	313.9	5.646	869.7	5.663	475.7	5.637	.....	.....	.....	.....
Jersey.....	Countess Flavia.....	441.2	6.050	491.5	5.770	415.9	5.139	599.5	5.056	.....	.....
	Barbara Allen.....	418.8	5.450	472.1	5.401	595.5	5.563	835.3	5.046	.....	.....
Jersey.....	Albert's Carol.....	466.5	5.537	438.6	5.730	.....	.....	.....	.....	.....	.....
	Average.....	407.6	5.668	443.0	5.656	505.7	5.779	612.4	5.541	.....	.....
Jersey.....	Average of individuals.....	461.6	4.531	573.0	4.647	587.9	4.473	759.3	4.490	902.3	3.673
	Average of breeds.....	456.0	4.411	535.1	4.536	598.0	4.337	770.1	4.476	909.3	3.673
Jersey.....	Average 23 cows, 1st and 2d periods.....	394.5	3.633	530.1	3.763	.....	.....	.....	.....	.....	.....
	Average 13 cows, 1st, 2d and 3d periods.....	451.2	4.497	539.1	4.496	587.9	4.473	.....	.....	.....	.....
Jersey.....	Average 6 cows, 1st, 2d, 3d and 4th periods.....	446.2	4.430	560.8	4.313	645.3	4.487	759.3	4.469	.....	.....
	One cow, 1st, 2d, 3d, 4th and 5th periods.....	475.7	4.463	466.6	3.648	645.3	3.764	694.9	3.936	903.3	3.673

TABLE 55. RELATIVE COST OF PRODUCTION OF MILK AND FAT—  
FIRST PERIOD OF LACTATION.

MILK.	Ratio.	FAT.	Ratio.
*Nora .....	100	Oriole .....	100
Netherland Constance .....	107	Countess Flavia .....	106
Ruth .....	108	*Nora .....	107
Queen Duchess .....	116	Albert's Carol .....	111
Manton Belle .....	118	Madam Select .....	112
Ione .....	124	Barbara Allen .....	117
Oriole .....	132	Genevie's Gift .....	119
Esel 2d .....	141	Stella Select .....	120
Beauty Pledge .....	141	Queen Duchess .....	120
Nellie 6th .....	141	Rosette Ford .....	123
Maggie 6th .....	142	Manton Belle .....	140
Junietta Peerless .....	142	Netherland Constance .....	143
Stella Select .....	145	Gilderbloom .....	146
Madam Select .....	151	Ruth .....	150
Artalia .....	151	Betsey 10th .....	151
Genevie's Gift .....	152	Daydream B. ....	151
Countess Flavia .....	157	Miss Flow 5th .....	152
Albert's Carol .....	158	Artalia .....	157
Barbara Allen .....	159	Maggie 6th .....	160
Miss Flow 5th .....	161	Nellie 6th .....	163
Betsey 10th .....	164	Ione .....	163
Rosette Ford .....	168	Beauty Pledge .....	171
Daydream B. ....	196	Esel 2d .....	180
Gilderbloom .....	200	Junietta Peerless .....	183
Lady Spencer .....	251	Lady Spencer .....	245

*By Breeds.*

Holstein-Friesian .....	100	Guernsey .....	100
American Holderness .....	103	Jersey .....	105
Ayrshire .....	108	American Holderness .....	126
Guernsey .....	120	Devon .....	130
Devon .....	125	Ayrshire .....	131
Jersey .....	135	Holstein-Friesian .....	141
Shorthorn .....	167	Shorthorn .....	175

\* Calculated to November 1, 1894, only.

TABLE 56. RELATIVE COST OF PRODUCTION OF MILK AND FAT—  
SECOND PERIOD OF LACTATION.

MILK.	Ratio.	FAT.	Ratio.
*Netherland Constance....	100	*Netherland Constance...	100
Beauty Pledge .....	147	Beauty Pledge .....	105
*Lady Spencer .....	169	*Betsey 10th.....	105
Betsey 10th.....	179	*Lady Spencer .....	106
Junietta Peerless.....	189	Oriole.....	109
Queen Duchess.....	192	Stella Select .....	110
Maggie 6th .....	200	Countess Flavia .....	113
Tolsma Artis.....	204	Madam Select.....	114
Manton Belle.....	205	Albert's Carol.....	116
Stella Select.....	213	Rosette Ford.....	122
Oriole.....	227	Genevie's Gift.....	123
Nellie 6th .....	229	Gilderbloom .....	126
Miss Flow 5th.....	230	Barbara Allen.....	130
Countess Flavia .....	239	Queen Duchess.....	141
Genevie's Gift.....	243	Maggie 6th .....	142
Esel 2d.....	246	Manton Belle .....	150
Barbara Allen.....	249	Ione .....	157
Gilderbloom .....	253	Junietta Peerless... ..	159
Albert's Carol.....	253	Artalia .....	166
Madam Select.....	264	Miss Flow 5th.....	177
Ione .....	265	Esel 2d.....	182
Rosette Ford.....	266	Nellie 6th .....	182
Artalia .....	270	Tolsma Artis.....	192

*By Breeds.*

Holstein-Friesian .....	100	Shorthorn .....	100
Shorthorn .....	100	Guernsey .....	107
Ayrshire .....	117	Jersey .....	114
American Holderness.....	123	Holstein-Friesian .....	136
Guernsey .....	139	Devon .....	140
Jersey .....	143	Ayrshire .....	148
Devon .....	149	American Holderness....	153

\* Calculated to November 1, 1894, only.

TABLE 57. RELATIVE COST OF PRODUCTION OF MILK AND FAT—  
THIRD PERIOD OF LACTATION.

MILK.	Ratio	FAT.	Ratio.
*Oriole .....	100	*Oriole .....	100
Nellie 6th. ....	107	†Ione .....	118
Junietta Peerless .....	112	†Stella Select .....	121
†Ione .....	114	Barbara Allen .....	123
†Stella Select .....	118	Gilderbloom .....	131
Tolsma Artis .....	130	Countess Flavia .....	136
Manton Belle .....	130	Junietta Peerless .....	155
Maggie 6th. ....	139	Maggie 6th .....	169
Barbara Allen .....	140	Manton Belle .....	172
Miss Flow 5th. ....	141	Miss Flow 5th. ....	193
Gilderbloom .....	153	Tolsma Artis .....	199
Countess Flavia .....	176	Nellie 6th .....	218
*Artalia .....	225	*Artalia .....	239

*By Breeds.*

Guernsey .....	100	Guernsey .....	100
American Holderness .....	112	Jersey .....	118
Ayrshire .....	117	Ayrshire .....	157
Holstein-Friesian .....	119	Devon .....	161
Jersey .....	143	American Holderness .....	175
Devon .....	155	Holstein-Friesian .....	180

TABLE 58. RELATIVE COST OF PRODUCTION OF MILK AND FAT--  
FOURTH PERIOD OF LACTATION.

MILK.	Ratio.	FAT.	Ratio.
*Junietta Peerless .....	100	Countess Flavia .....	100
*Maggie 6th .....	106	*Maggie 6th .....	100
Manton Belle .....	138	*Barbara Allen .....	104
*Barbara Allen .....	152	*Junietta Peerless .....	105
Countess Flavia .....	175	Manton Belle .....	138
Miss Flow 5th. ....	182	Miss Flow 5th. ....	162

*By Breeds.*

American Holderness .....	100	American Holderness .....	100
Ayrshire .....	132	Jersey .....	102
Jersey .....	154	Ayrshire .....	135

\* Calculated to November 1, 1894, only.

† Died before completion of period.

TABLE 59. COST OF MILK PER POUND FOR WHOLE MILK PERIOD.

Number of periods.	NAME OF COW.	Cost, cents	Ratio.
2	Netherland Constance .....	.549	100
1	Nora .....	.655	118
4	Junietta Peerless .....	.697	127
1	Ruth .....	.709	129
4	Manton Belle .....	.744	136
2	Beauty Pledge .....	.755	138
2	Queen Duchess .....	.759	138
2	Tolsma Artis .....	.779	142
3	Oriole .....	.781	142
3	Nellie 6th .....	.813	148
3	Stella Select .....	.825	150
5	Miss Flow 5th .....	.829	151
3	Ione .....	.839	153
4	Maggie 6th .....	.841	153
4	Barbara Allen .....	.885	161
2	Betsey 10th .....	.894	163
2	Esel 2d .....	.949	173
4	Countess Flavia .....	.950	173
2	Genevie's Gift .....	.985	179
2	Madam Select .....	1.016	185
2	Albert's Carol .....	1.018	185
3	Gilderbloom .....	1.065	194
2	Rosette Ford .....	1.077	196
3	Artalia .....	1.120	204
2	Lady Spencer .....	1.156	211
1	Daydream .....	1.284	224
	Average .....	.884	.....
	Holstein-Friesian .....	.748	100
	Ayrshire .....	.767	101
	American Holderness .....	.770	103
	Guernsey .....	.925	124
	Jersey .....	.979	131
	Shorthorn .....	1.025	137
	Devon .....	1.057	141
	Average .....	.8944	.....

TABLE 60. COST OF FAT PER POUND FOR WHOLE MILK PERIOD.

Number of periods.	NAME OF COW.	Cost, cents.	Ratio.
3	Oriole .....	14.9	100
4	Countess Flavia.....	15.9	106
4	Barbara Allen .....	16.8	113
3	Stella Select.....	16.8	113
2	Madam Select .....	17.5	117
1	Nora .....	17.5	117
2	Albert's Carol .....	17.6	118
3	Genevie's Gift .....	18.8	126
2	Rosette Ford.....	19.0	127
2	Netherland Constance .....	19.1	128
3	Gilderbloom .....	19.5	131
2	Betsey 10th .....	20.1	135
2	Queen Duchess .....	20.2	136
4	Maggie 6th .....	20.2	136
4	Manton Belle.....	21.1	142
3	Ione .....	21.4	144
4	Junietta Peerless.....	21.5	144
2	Beauty Pledge.....	21.7	146
5	Miss Flow 5th .....	22.0	148
1	Ruth .....	24.4	164
1	Daydream B .....	24.7	166
3	Artalia .....	26.3	176
2	Tolsma Artis .....	26.3	176
3	Nellie 6th.....	26.7	179
2	Lady Spencer.....	27.8	187
2	Eel 2d .....	28.1	189
	Average .....	21.0	.....
	Guernsey .....	17.0	100
	Jersey .....	17.4	102
	Ayrshire .....	21.2	125
	American Holderness .....	21.5	126
	Devon .....	22.8	134
	Holstein-Friesian .....	23.9	141
	Shorthorn .....	23.9	141
	Average.....	21.1	.....

TABLE 61. NUMBER OF DAYS AND MILK YIELD IN DIFFERENT PERIODS OF LACTATION—MORNING AND EVENING—CONTINUED FROM TWELFTH ANNUAL REPORT.

Breed.	NAME OF COW.	FIRST PERIOD.			SECOND PERIOD.			THIRD PERIOD.			FOURTH PERIOD.			FIFTH PERIOD.		
		Number of days	Yield of A. M.	Yield of P. M.	Number of days	Yield of A. M.	Yield of P. M.	Number of days	Yield of A. M.	Yield of P. M.	Number of days	Yield of A. M.	Yield of P. M.	Number of days	Yield of A. M.	Yield of P. M.
Ayrshire.	Miss Flow 6th	337	2704.8	2846.4	365	2761.5	2857.8	309	2824.7	3094.2	314	2813.3	3079.4	*173	2466.9	2856.1
	Manton Belle.	273	2461.0	2333.8	233	3166.3	3061.7	254	4453.7	4222.7	306	3354.6	3711.1	.....	.....	.....
	Ayrshire.	431	2860.7	2961.9	330	2739.3	2807.8	360	4693.4	4548.4	*154	3235.4	2461.8	.....	.....	.....
	Junietta Peerless.	450	4693.0	4793.2	315	3609.8	3545.9	.....	.....	.....	.....	.....	.....	.....	.....	.....
	Queen Duchess.	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
	Total	1,631	13704.5	13835.3	1,323	13879.5	13773.2	1,023	13372.8	11860.4	776	9708.3	9351.8	172	2466.9	2856.1
Guernsey.	Rosette Ford.	704	4030.2	4110.9	449	3655.3	3570.3	.....	.....	.....	.....	.....	.....	.....	.....	.....
	Orfale	728	5155.2	5408.6	406	3251.8	3400.7	*948	3313.0	3105.2	.....	.....	.....	.....	.....	.....
	Stella Select.	413	2855.8	2992.8	263	2831.7	2909.4	4118	984.0	965.1	.....	.....	.....	.....	.....	.....
	Madam Select.	286	1414.2	1436.8	263	2402.4	2541.9	.....	.....	.....	.....	.....	.....	.....	.....	.....
	Total	2,076	14155.5	14907.6	1,363	12535.3	12473.2	361	4197.0	4068.2	.....	.....	.....	.....	.....	.....
Jersey.	Gilderbloom.	534	2745.8	2873.2	262	2454.1	2385.9	555	4150.0	4075.3	.....	.....	.....	.....	.....	.....
	Countess Flavia.	540	4093.4	3953.7	267	3617.6	3267.4	319	2349.9	2261.4	348	3359.3	2867.8	.....	.....	.....
	Barbara Allen.	536	4092.2	2947.8	265	2705.1	2956.2	331	2343.8	2351.2	*197	3055.5	2657.3	.....	.....	.....
	Albert's Carol.	534	3356.0	2477.0	251	2383.0	2156.2	.....	.....	.....	.....	.....	.....	.....	.....	.....
	Total	2,194	14408.4	12861.8	1,445	10033.8	9736.8	1,315	9748.7	9687.9	545	5014.7	5008.1	.....	.....	.....
American Holderness.	Nelle 6th.	290	3065.6	2960.2	316	3248.1	2382.7	371	1538.5	1032.5	.....	.....	.....	.....	.....	.....
	Maggie 6th.	467	3101.7	2969.6	518	3066.8	2867.1	391	3661.5	2860.9	*174	2327.7	2366.7	.....	.....	.....
	Nora	*318	3075.7	3063.4	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
	Total	1,136	8973.0	8932.2	634	5414.8	5380.8	563	4354.0	4974.4	174	2327.7	2366.7	.....	.....	.....
	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Holstein-Friesian.	Evel 2d	733	6935.5	6792.8	395	3916.6	3814.2	.....	.....	.....	.....	.....	.....	.....	.....	.....
	Tolmas Ardis	268	2781.8	2695.5	281	4059.8	4015.4	345	4338.7	4330.1	.....	.....	.....	.....	.....	.....

† Died before completion of period.

\* Only calculated to November 1, 1894

NUMBER OF DAYS AND MILK YIELD, ETC.— (Concluded).

Breed.	NAME OF COW.	FIRST PERIOD.			SECOND PERIOD.			THIRD PERIOD.			FOURTH PERIOD.			FIFTH PERIOD.		
		Number of days.	Yield of A. M.	Yield of P. M.	Number of days.	Yield of A. M.	Yield of P. M.	Number of days.	Yield of A. M.	Yield of P. M.	Number of days.	Yield of A. M.	Yield of P. M.	Number of days.	Yield of A. M.	Yield of P. M.
Holstein-Friesian	Netherland Constance	581	7071.8	6850.9	*129	2336.5	2315.6	.....	.....	.....	.....	.....	.....	.....	.....	.....
Holstein-Friesian	Beauty Pledge	569	4791.9	4593.5	529	4418.0	4087.6	.....	.....	.....	.....	.....	.....	.....	.....	.....
Holstein-Friesian	Ruth	386	3151.7	3191.5	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
	Total	2,497	24738.7	24036.2	1,305	14730.9	14293.8	345	4388.7	4330.1	.....	.....	.....	.....	.....	.....
Devon	Ione	416	2851.9	2871.3	374	2039.0	1907.3	1167	1734.0	1736.2	.....	.....	.....	.....	.....	.....
Devon	Genevieve's Gift	437	2910.8	1965.5	305	2030.8	1938.7	.....	.....	.....	.....	.....	.....	.....	.....	.....
Devon	Day Dream B	381	1450.7	1417.3	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Devon	Aralia	459	3140.3	3054.8	364	1886.3	1900.7	*238	857.8	861.1	.....	.....	.....	.....	.....	.....
	Total	1,693	9033.6	8706.9	943	5896.6	5690.7	395	2631.8	2637.3	.....	.....	.....	.....	.....	.....
Shorthorn	Betsy 10th	511	3574.3	3394.8	*340	3033.2	3554.4	.....	.....	.....	.....	.....	.....	.....	.....	.....
Shorthorn	Lady Spencer	448	2335.6	2303.6	*271	2464.9	2410.8	.....	.....	.....	.....	.....	.....	.....	.....	.....
	Total	959	5909.8	5598.4	611	7397.1	6975.3	.....	.....	.....	.....	.....	.....	.....	.....	.....
	Grand total	12,178	90123.5	89887.4	7,598	66379.4	67100.8	3,901	37897.0	37008.4	1,495	16945.7	16333.6	172	2456.9	2326.1
	Ratio	.....	100	97.9	.....	100	96.7	.....	160	97.7	.....	100	97.6	.....	100	95.9

\* Only calculated to November 1, 1894.

† Died before completion of period.



TABLE 63. YIELD OF MILK AND PER CENT. OF FAT, EACH COW, EACH MONTH OF EACH LACTATION.  
*Jersey.*

	COUNTESS FLAVIA.						BARBARA ALLEN.					
	FIRST PERIOD.		SECOND PERIOD.		THIRD PERIOD.		FOURTH PERIOD.		FIRST PERIOD.		SECOND PERIOD.	
	Milk yield.	Per cent. fat.	Milk yield.	Per cent. fat.	Milk yield.	Per cent. fat.	Milk yield.	Per cent. fat.	Milk yield.	Per cent. fat.	Milk yield.	Per cent. fat.
Lactation begun .....	300th.	.....	18th.	.....	14th.	.....	4th.	.....	30th.	.....	11th.	.....
First month .....	171.8	5.36	240.0	5.43	243.2	5.90	512.2	5.37	519.0	4.93	690.8	4.76
Second month .....	637.7	4.84	780.8	5.03	689.7	5.91	731.8	5.73	501.7	5.05	643.0	4.94
Third month .....	614.5	5.33	636.8	6.17	590.5	6.38	698.9	6.30	494.3	5.33	633.8	4.49
Fourth month .....	890.5	5.36	506.7	6.16	477.1	6.36	625.6	6.10	450.6	5.55	563.4	4.68
Fifth month .....	874.0	5.37	584.1	5.33	531.4	6.06	698.6	6.36	486.3	5.70	633.7	4.80
Sixth month .....	493.4	6.13	491.1	6.33	496.4	6.30	598.3	6.00	419.9	5.43	480.6	5.14
Seventh month .....	471.1	6.09	506.7	6.03	479.8	6.33	573.6	6.73	437.4	5.39	456.3	5.56
Eighth month .....	442.7	6.41	453.9	5.06	391.6	6.06	433.6	6.47	416.1	5.46	374.9	6.03
Ninth month .....	448.9	6.19	451.3	4.84	363.3	6.03	413.0	5.77	463.3	5.34	356.7	6.66
Tenth month .....	419.8	6.45	319.8	6.44	348.6	5.96	381.3	5.65	471.7	5.15	370.6	6.75
Eleventh month .....	365.8	6.35	375.0	6.15	194.8	6.50	.....	.....	444.0	5.63	166.4	6.40
Twelfth month .....	409.8	6.66	.....	.....	.....	.....	.....	.....	387.1	5.63	.....	.....
Thirteenth month .....	431.7	5.87	.....	.....	.....	.....	.....	.....	367.4	5.41	.....	.....
Fourteenth month .....	406.3	5.87	.....	.....	.....	.....	.....	.....	310.7	6.16	.....	.....
Fifteenth month .....	408.1	5.89	.....	.....	.....	.....	.....	.....	381.9	6.37	.....	.....
Sixteenth month .....	.....	6.33	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Seventeenth month .....	377.9	6.38	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Eighteenth month .....	361.9	6.07	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Nineteenth month .....	87.0	6.30	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Total yield .....	2094.4	.....	5136.1	.....	4711.3	.....	5657.6	.....	6950	.....	5033.1	.....
Average .....	.....	6.060	.....	5.770	.....	6.139	.....	6.096	.....	5.450	.....	5.401
Lactation ended .....	35th.	.....	30th.	.....	30th.	.....	31st.	.....	31st.	.....	31st.	.....

## Jersey — (Concluded.)

	BARBARA ALLEN.				GILDERBLOOM.				ALBERT'S CAROL.			
	THIRD PERIOD.		FOURTH PERIOD.		FIRST PERIOD.		SECOND PERIOD.		FIRST PERIOD.		SECOND PERIOD.	
	Milk yield.	Per cent. fat.	Milk yield.	Per cent. fat.	Milk yield.	Per cent. fat.	Milk yield.	Per cent. fat.	Milk yield.	Per cent. fat.	Milk yield.	Per cent. fat.
Lactation begun.....	5th.	.....	17th.	.....	10th.	.....	18th.	.....	1st.	.....	1st.	.....
First month.....	637.7	4.15	161.7	5.00	341.1	6.03	595.9	5.39	603.6	3.99	434.3	5.30
Second month.....	734.3	4.30	738.1	4.86	535.6	5.63	530.1	5.33	533.6	4.59	533.1	6.13
Third month.....	783.3	5.33	680.8	4.69	473.8	5.30	649.3	5.00	534.0	4.03	565.0	5.97
Fourth month.....	637.6	4.90	690.3	5.35	410.7	6.16	519.4	4.73	450.7	4.64	433.4	6.03
Fifth month.....	738.9	4.90	689.1	5.43	436.4	5.37	513.4	4.55	433.6	4.50	438.4	6.13
Sixth month.....	634.5	6.00	.....	.....	343.3	5.37	433.0	4.95	433.3	5.14	438.1	6.15
Seventh month.....	573.3	6.45	.....	.....	345.0	5.37	433.0	4.95	433.3	5.14	438.1	6.15
Eighth month.....	587.5	6.10	.....	.....	307.1	5.63	331.1	5.10	433.3	5.14	438.1	6.15
Ninth month.....	541.1	6.10	.....	.....	335.8	5.33	367.8	5.65	433.3	5.14	438.1	6.15
Tenth month.....	405.4	6.40	.....	.....	315.5	5.60	350.0	6.45	433.3	5.14	438.1	6.15
Eleventh month.....	169.9	6.00	.....	.....	331.0	4.91	315.1	6.46	433.3	5.14	438.1	6.15
Twelfth month.....	.....	.....	.....	.....	335.5	4.97	315.1	6.46	433.3	5.14	438.1	6.15
Thirteenth month.....	.....	.....	.....	.....	304.6	5.41	371.9	6.95	433.3	5.14	438.1	6.15
Fourteenth month.....	.....	.....	.....	.....	183.3	6.33	364.9	5.90	433.3	5.14	438.1	6.15
Fifteenth month.....	.....	.....	.....	.....	155.9	5.87	333.5	5.60	433.3	5.14	438.1	6.15
Sixteenth month.....	.....	.....	.....	.....	164.3	6.45	333.4	5.80	433.3	5.14	438.1	6.15
Seventeenth month.....	.....	.....	.....	.....	123.9	5.97	333.0	6.00	433.3	5.14	438.1	6.15
Eighteenth month.....	.....	.....	.....	.....	.....	.....	.....	.....	433.3	5.14	438.1	6.15
Nineteenth month.....	.....	.....	.....	.....	.....	.....	.....	.....	433.3	5.14	438.1	6.15
Total yield.....	6432.3	.....	3046.9	.....	1341.6	.....	4733.5	.....	5133.1	.....	4383.9	.....
Average.....	.....	5.53	.....	5.04	.....	5.65	.....	5.63	.....	5.37	.....	5.70
Lactation ended.....	31st.	.....	31st.	.....	31st.	.....	39th.	.....	31st.	.....	31st.	.....

TABLE 64. YIELD OF MILK AND PER CENT. OF FAT, EACH COW, EACH MONTH OF EACH LACTATION.  
*Guernsey.*

	STELLA SELECT						ORIOLE			
	FIRST PERIOD.		SECOND PERIOD.		THIRD PERIOD.		FIRST PERIOD.		SECOND PERIOD.	
	Milk yield.	Per cent. fat.	Milk yield.	Per cent. fat.	Milk yield.	Per cent. fat.	Milk yield.	Per cent. fat.	Milk yield.	Per cent. fat.
Lactation begun.....	32d.	.....	1st.	.....	7th	.....	8th.	.....	8th.	.....
First month.....	136.4	3.85	810.6	3.88	387.8	3.85	306.4	6.88	415.4	5.68
Second month.....	743.0	3.94	894.1	4.08	596.9	4.15	440.0	4.94	728.8	5.08
Third month.....	636.6	4.13	783.3	4.60	534.4	5.10	478.4	4.31	630.3	5.37
Fourth month.....	603.4	3.95	789.5	5.08	.....	.....	536.3	4.45	651.3	5.60
Fifth month.....	610.9	4.48	639.7	5.55	.....	.....	537.3	4.90	639.5	5.38
Sixth month.....	616.0	3.68	539.4	6.00	.....	.....	551.3	4.84	646.5	5.87
Seventh month.....	596.0	4.30	515.1	6.50	.....	.....	559.3	4.85	558.9	5.35
Eighth month.....	397.7	4.88	315.5	6.30	.....	.....	577.9	4.96	558.9	5.17
Ninth month.....	493.7	5.87	306.1	7.35	.....	.....	560.6	5.32	540.5	5.95
Tenth month.....	383.3	5.87	197.0	6.00	.....	.....	475.3	5.30	530.3	5.45
Eleventh month.....	394.7	6.31	144.1	5.80	.....	.....	531.8	5.65	540.5	5.45
Twelfth month.....	381.4	6.45	55.6	.....	.....	.....	495.5	5.24	548.6	5.65
Thirteenth month.....	380.0	7.00	.....	.....	.....	.....	533.4	5.31	501.0	7.00
Fourteenth month.....	316.0	6.45	.....	.....	.....	.....	510.3	5.63	301.0	7.00
Fifteenth month.....	83.3	6.40	.....	.....	.....	.....	390.3	6.05	.....	.....
Sixteenth month.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Total yield.....	6580.3	.....	5737.9	.....	1519.1	.....	7386.8	.....	7013.5	.....
Average.....	.....	5.147	.....	5.533	.....	4.387	.....	5.395	.....	5.707
Lactation ended.....	34th.	.....	27th.	.....	31st.	.....	33th.	.....	16th.	.....

*Guernsey -- (Concluded).*

	ORIGLE.			ROSETTE FORD.			MADAM SELECT.		
	THIRD PERIOD.			FIRST PERIOD.			SECOND PERIOD.		
	Milk yield.	Per cent. fat.		Milk yield.	Per cent. fat.		Milk yield.	Per cent. fat.	
Lactation began.....	28th.	.....	14th.	1st.	.....	2nd.	12th.	.....	
First month.....	46.7	5.00	195.4	698.6	5.31	100.9	346.9	5.10	
Second month.....	991.9	4.68	543.4	5.41	5.30	518.9	581.7	5.80	
Third month.....	523.0	4.56	561.5	1019.2	5.55	518.9	581.7	5.80	
Fourth month.....	573.4	4.70	452.3	4.74	5.36	326.4	509.9	6.31	
Fifth month.....	747.6	4.30	501.9	4.90	5.58	495.0	490.9	6.48	
Sixth month.....	779.0	4.88	478.8	5.12	5.98	326.9	477.4	6.90	
Seventh month.....	730.3	4.66	515.9	5.08	5.70	319.1	443.8	5.92	
Eighth month.....	.....	.....	476.1	4.81	6.18	319.1	443.8	6.14	
Ninth month.....	.....	.....	463.7	4.75	6.65	353.0	385.6	6.08	
Tenth month.....	.....	.....	463.7	4.74	6.27	80.7	183.4	5.92	
Eleventh month.....	.....	.....	463.0	4.74	6.25	.....	.....	.....	
Twelfth month.....	.....	.....	380.4	5.71	6.10	.....	.....	.....	
Thirteenth month.....	.....	.....	366.9	5.98	6.60	.....	.....	.....	
Fourteenth month.....	.....	.....	347.3	6.30	7.60	.....	.....	.....	
Fifteenth month.....	.....	.....	304.3	6.16	7.05	.....	.....	.....	
Sixteenth month.....	.....	.....	301.7	6.60	7.27	.....	.....	.....	
.....	.....	.....	333.7	6.85	.....	.....	.....	.....	
Total yield.....	5090.9	.....	6034.3	.....	.....	3240.3	5081.3	.....	
Average.....	.....	4.667	.....	5.415	.....	.....	5.484	.....	
Lactation ended.....	31st.	.....	28th.	16th.	.....	12th.	30th.	.....	

TABLE 65. YIELD OF MILK AND PER CENT. OF FAT, EACH COW, EACH MONTH OF EACH LACTATION.  
*Holstein-Friesian.*

	TOLSKA ARTIS.						EDEL 2D.						BEAUTY PLEDGE.			
	FIRST PERIOD.			SECOND PERIOD.			THIRD PERIOD.			FIRST PERIOD.			SECOND PERIOD.			
	Milk yield.	Per cent. fat.	Milk yield.	Per cent. fat.	Milk yield.	Per cent. fat.	Milk yield.	Per cent. fat.	Milk yield.	Per cent. fat.	Milk yield.	Per cent. fat.	Milk yield.	Per cent. fat.	Milk yield.	Per cent. fat.
Lactation begun.....	24th	.....	4th	.....	80th	.....	1st	.....	5th	.....	10th	.....	.....	.....	.....	.....
First month.....	24th	3.45	705.5	3.31	727.0	3.36	1st	3.50	428.8	3.50	10th	3.50	428.8	3.50	10th	3.50
Second month.....	24th	3.35	1083.5	3.31	1083.5	3.35	1st	3.18	937.4	3.18	10th	3.18	937.4	3.18	10th	3.18
Third month.....	24th	3.25	1083.5	3.25	1083.5	3.25	1st	3.18	1083.4	3.18	10th	3.18	1083.4	3.18	10th	3.18
Fourth month.....	24th	3.25	731.4	3.25	731.4	3.25	1st	3.18	731.4	3.18	10th	3.18	731.4	3.18	10th	3.18
Fifth month.....	24th	3.25	731.4	3.25	731.4	3.25	1st	3.18	731.4	3.18	10th	3.18	731.4	3.18	10th	3.18
Sixth month.....	24th	3.25	731.4	3.25	731.4	3.25	1st	3.18	731.4	3.18	10th	3.18	731.4	3.18	10th	3.18
Seventh month.....	24th	3.25	731.4	3.25	731.4	3.25	1st	3.18	731.4	3.18	10th	3.18	731.4	3.18	10th	3.18
Eighth month.....	24th	3.25	731.4	3.25	731.4	3.25	1st	3.18	731.4	3.18	10th	3.18	731.4	3.18	10th	3.18
Ninth month.....	24th	3.25	731.4	3.25	731.4	3.25	1st	3.18	731.4	3.18	10th	3.18	731.4	3.18	10th	3.18
Tenth month.....	24th	3.25	731.4	3.25	731.4	3.25	1st	3.18	731.4	3.18	10th	3.18	731.4	3.18	10th	3.18
Eleventh month.....	24th	3.25	731.4	3.25	731.4	3.25	1st	3.18	731.4	3.18	10th	3.18	731.4	3.18	10th	3.18
Twelfth month.....	24th	3.25	731.4	3.25	731.4	3.25	1st	3.18	731.4	3.18	10th	3.18	731.4	3.18	10th	3.18
Thirteenth month.....	24th	3.25	731.4	3.25	731.4	3.25	1st	3.18	731.4	3.18	10th	3.18	731.4	3.18	10th	3.18
Fourteenth month.....	24th	3.25	731.4	3.25	731.4	3.25	1st	3.18	731.4	3.18	10th	3.18	731.4	3.18	10th	3.18
Fifteenth month.....	24th	3.25	731.4	3.25	731.4	3.25	1st	3.18	731.4	3.18	10th	3.18	731.4	3.18	10th	3.18
Sixteenth month.....	24th	3.25	731.4	3.25	731.4	3.25	1st	3.18	731.4	3.18	10th	3.18	731.4	3.18	10th	3.18
Seventeenth month.....	24th	3.25	731.4	3.25	731.4	3.25	1st	3.18	731.4	3.18	10th	3.18	731.4	3.18	10th	3.18
Eighteenth month.....	24th	3.25	731.4	3.25	731.4	3.25	1st	3.18	731.4	3.18	10th	3.18	731.4	3.18	10th	3.18
Total yield.....	5401.3	.....	8560.9	.....	11917.7	.....	7761.7	.....	6905.2	.....	8394.7	.....	.....	.....	.....	.....
Average.....	3.467	.....	3.934	.....	3.931	.....	3.931	.....	3.931	.....	3.931	.....	3.931	.....	3.931	.....
Lactation ended.....	28th	.....	11th	.....	31st	.....	30th	.....	31st	.....	31st	.....	31st	.....	31st	.....

TABLE 66. YIELD OF MILK AND PER CENT. OF FAT, EACH COW, EACH MONTH OF EACH LACTATION.  
*Devon.*

	IONE.						ARTALIA.						GENEVIE'S GIFT.					
	FIRST PERIOD.			SECOND PERIOD.			FIRST PERIOD.			SECOND PERIOD.			FIRST PERIOD.			SECOND PERIOD.		
	Milk yield.	Per cent. fat.	Per cent. fat.	Milk yield.	Per cent. fat.	Per cent. fat.	Milk yield.	Per cent. fat.	Per cent. fat.	Milk yield.	Per cent. fat.	Per cent. fat.	Milk yield.	Per cent. fat.	Per cent. fat.	Milk yield.	Per cent. fat.	Per cent. fat.
Lactation begun.....	18th.	3.50	4.90	1st.	30th.	4.59	1st.	4.59	18th.	1st.	4.59	30th.	1st.	4.59	30th.	1st.	4.40	4.40
First month.....	333.0	3.50	4.90	735.6	4.90	4.90	526.1	4.90	18th.	18th.	4.59	18th.	1st.	4.59	18th.	1st.	4.40	4.40
Second month.....	433.9	3.50	4.90	748.1	4.90	4.90	527.1	4.90	18th.	18th.	4.59	18th.	1st.	4.59	18th.	1st.	4.40	4.40
Third month.....	473.7	3.50	4.90	763.8	4.90	4.90	527.1	4.90	18th.	18th.	4.59	18th.	1st.	4.59	18th.	1st.	4.40	4.40
Fourth month.....	471.3	3.50	4.90	763.8	4.90	4.90	527.1	4.90	18th.	18th.	4.59	18th.	1st.	4.59	18th.	1st.	4.40	4.40
Fifth month.....	460.4	3.50	4.90	763.8	4.90	4.90	527.1	4.90	18th.	18th.	4.59	18th.	1st.	4.59	18th.	1st.	4.40	4.40
Sixth month.....	393.4	3.50	4.90	763.8	4.90	4.90	527.1	4.90	18th.	18th.	4.59	18th.	1st.	4.59	18th.	1st.	4.40	4.40
Seventh month.....	323.5	3.50	4.90	763.8	4.90	4.90	527.1	4.90	18th.	18th.	4.59	18th.	1st.	4.59	18th.	1st.	4.40	4.40
Eighth month.....	346.0	3.50	4.90	763.8	4.90	4.90	527.1	4.90	18th.	18th.	4.59	18th.	1st.	4.59	18th.	1st.	4.40	4.40
Ninth month.....	311.9	3.50	4.90	763.8	4.90	4.90	527.1	4.90	18th.	18th.	4.59	18th.	1st.	4.59	18th.	1st.	4.40	4.40
Tenth month.....	305.1	3.50	4.90	763.8	4.90	4.90	527.1	4.90	18th.	18th.	4.59	18th.	1st.	4.59	18th.	1st.	4.40	4.40
Eleventh month.....	305.1	3.50	4.90	763.8	4.90	4.90	527.1	4.90	18th.	18th.	4.59	18th.	1st.	4.59	18th.	1st.	4.40	4.40
Twelfth month.....	305.1	3.50	4.90	763.8	4.90	4.90	527.1	4.90	18th.	18th.	4.59	18th.	1st.	4.59	18th.	1st.	4.40	4.40
Thirteenth month.....	158.0	3.50	4.90	763.8	4.90	4.90	527.1	4.90	18th.	18th.	4.59	18th.	1st.	4.59	18th.	1st.	4.40	4.40
Fourteenth month.....	58.0	3.50	4.90	763.8	4.90	4.90	527.1	4.90	18th.	18th.	4.59	18th.	1st.	4.59	18th.	1st.	4.40	4.40
Total yield.....	4581.9	.....	.....	3949.0	.....	.....	5031.1	.....	.....	3937.3	.....	.....	5433.4	.....	.....	4007.3	.....	.....
Average.....	.....	4.550	.....	.....	4.733	.....	.....	5.035	.....	.....	4.400	.....	.....	5.108	.....	.....	5.410	.....
Lactation en'd.....	8th.	.....	.....	94th.	.....	.....	81st.	.....	.....	17th.	.....	.....	31st.	.....	.....	16th.	.....	.....

\* Died the 14th of the month.

TABLE 67. YIELD OF MILK AND PER CENT. OF FAT, EACH COW, EACH MONTH OF EACH LACTATION.  
*Ayrshire.*

	MISS FLOW BTH.										JUNETTA PERLESS.			
	FIRST PERIOD.		SECOND PERIOD.		THIRD PERIOD.		FOURTH PERIOD.		FIFTH PERIOD.		FIRST PERIOD.		SECOND PERIOD.	
	Milk yield.	Per cent. fat.	Milk yield.	Per cent. fat.	Milk yield.	Per cent. fat.	Milk yield.	Per cent. fat.	Milk yield.	Per cent. fat.	Milk yield.	Per cent. fat.	Milk yield.	Per cent. fat.
Lactation begun.....	6th.	.....	1st.	.....	6th.	.....	30th.	.....	18th.	.....	16th.	.....	2d.	.....
First month.....	383.5	5.00	541.4	3.97	605.4	3.78	305.3	3.76	454.7	3.05	133.5	3.05	892.7	4.15
Second month.....	586.1	3.95	591.7	2.98	305.2	3.00	910.5	3.77	864.3	3.89	451.5	2.97	908.6	2.98
Third month.....	573.6	3.91	694.3	3.17	917.5	3.79	84.9	3.75	967.7	3.55	493.6	2.94	938.1	3.60
Fourth month.....	598.0	4.00	604.8	3.40	798.7	3.47	798.4	3.93	981.1	3.30	512.4	2.86	998.3	2.55
Fifth month.....	591.6	3.80	585.3	3.47	692.1	3.18	784.0	3.53	.....	.....	487.0	2.78	799.6	3.74
Sixth month.....	594.4	4.11	533.3	3.90	715.9	3.84	780.0	3.70	.....	.....	458.9	2.73	809.5	3.15
Seventh month.....	51.7	4.05	463.3	3.76	614.5	3.89	671.8	4.09	.....	.....	466.1	3.91	743.1	3.89
Eighth month.....	449.5	4.37	468.2	3.70	505.8	4.31	570.4	4.10	.....	.....	457.1	3.13	876.9	3.85
Ninth month.....	431.5	4.34	410.0	3.40	383.9	4.63	460.5	4.15	.....	.....	435.8	3.09	465.3	4.13
Ten'th month.....	383.9	4.95	346.5	3.56	169.3	5.35	330.3	4.40	.....	.....	410.1	2.91	169.7	4.33
Eleventh month.....	173.9	4.80	.....	.....	.....	.....	64.0	4.68	.....	.....	434.9	2.93	49.3	4.30
Twelfth month.....	38.5	5.67	30.0	4.38	.....	.....	.....	.....	.....	.....	409.7	2.88	.....	.....
Thirteenth month.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	305.7	3.70	.....	.....
Fourteenth month.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	176.0	4.60	.....	.....
Fifteenth month.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	69.9	6.90	.....	.....
Total yield.....	5351.3	.....	5399.3	.....	6302.4	.....	5390.3	.....	3307.8	.....	5753.2	.....	7347.1	.....
Average.....	.....	4.463	.....	3.645	.....	3.704	.....	3.905	.....	3.673	.....	3.377	.....	3.415
Lactation ended.....	6th.	.....	1st.	.....	28th.	.....	21st.	.....	31st.	.....	30th.	.....	21st.	.....

## REPORT OF THE DIRECTOR OF THE

## Ayrshire — (Concluded).

	JUNETTA PEERLESS.						MANTON BELLE.						QUEEN DUCHESS.					
	THIRD PERIOD.			FOURTH PERIOD.			FIRST PERIOD.			SECOND PERIOD.			FIRST PERIOD.			SECOND PERIOD.		
	Milk yield.	Per cent. fat.	Per cent. fat.	Milk yield.	Per cent. fat.	Per cent. fat.	Milk yield.	Per cent. fat.	Per cent. fat.	Milk yield.	Per cent. fat.	Per cent. fat.	Milk yield.	Per cent. fat.	Per cent. fat.	Milk yield.	Per cent. fat.	Per cent. fat.
Lactation begun.....	6th.	.....	.....	30th.	.....	.....	11th.	.....	.....	3d.	.....	.....	24th.	.....	.....	1st.	.....	.....
First month.....	817.7	4.06	5.80	94.9	3.94	4.00	327.8	4.00	4.39	814.4	3.95	4.03	99.7	3.96	3.95	715.4	3.79	3.79
Second month.....	1068.8	3.94	4.19	945.5	3.94	3.10	649.6	3.10	3.96	873.0	3.10	3.35	806.7	4.35	3.95	915.9	3.80	3.80
Third month.....	1068.0	3.91	4.19	945.5	3.94	3.10	649.6	3.10	3.96	873.0	3.10	3.35	806.7	4.35	3.95	915.9	3.80	3.80
Fourth month.....	928.6	3.91	4.19	1068.8	3.07	3.63	714.2	3.63	4.73	789.6	3.63	3.57	701.6	3.91	3.73	873.3	3.73	3.73
Fifth month.....	928.6	3.91	4.19	1068.8	3.07	3.63	714.2	3.63	4.73	789.6	3.63	3.57	701.6	3.91	3.73	873.3	3.73	3.73
Sixth month.....	928.6	3.91	4.19	1068.8	3.07	3.63	714.2	3.63	4.73	789.6	3.63	3.57	701.6	3.91	3.73	873.3	3.73	3.73
Seventh month.....	874.8	3.73	.....	.....	.....	3.95	654.5	3.95	3.13	747.6	3.13	3.56	706.9	3.78	3.95	836.3	3.67	3.67
Eighth month.....	898.1	3.63	.....	.....	.....	3.95	654.5	3.95	3.13	747.6	3.13	3.56	706.9	3.78	3.95	836.3	3.67	3.67
Ninth month.....	760.4	4.05	.....	.....	.....	3.95	654.5	3.95	3.13	747.6	3.13	3.56	706.9	3.78	3.95	836.3	3.67	3.67
Tenth month.....	468.6	3.95	.....	.....	.....	3.95	654.5	3.95	3.13	747.6	3.13	3.56	706.9	3.78	3.95	836.3	3.67	3.67
Eleventh month.....	933.1	4.00	.....	.....	.....	3.95	654.5	3.95	3.13	747.6	3.13	3.56	706.9	3.78	3.95	836.3	3.67	3.67
Twelfth month.....	143.4	4.30	.....	.....	.....	3.95	654.5	3.95	3.13	747.6	3.13	3.56	706.9	3.78	3.95	836.3	3.67	3.67
Thirteenth month.....	.....	.....	.....	.....	.....	3.95	654.5	3.95	3.13	747.6	3.13	3.56	706.9	3.78	3.95	836.3	3.67	3.67
Fourteenth month.....	.....	.....	.....	.....	.....	3.95	654.5	3.95	3.13	747.6	3.13	3.56	706.9	3.78	3.95	836.3	3.67	3.67
Fifteenth month.....	.....	.....	.....	.....	.....	3.95	654.5	3.95	3.13	747.6	3.13	3.56	706.9	3.78	3.95	836.3	3.67	3.67
Sixteenth month.....	.....	.....	.....	.....	.....	3.95	654.5	3.95	3.13	747.6	3.13	3.56	706.9	3.78	3.95	836.3	3.67	3.67
Total yield.....	9994.4	.....	.....	3096.6	.....	.....	6795.8	.....	.....	6395.0	.....	.....	9499.3	.....	.....	7199.3	.....	.....
Average.....	.....	3.63	.....	.....	3.463	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	3.955	.....
Lactation ended.....	30th.	.....	.....	31st.	.....	.....	17th.	.....	.....	2nd.	.....	.....	31st.	.....	.....	12th.	.....	.....

TABLE 68. YIELD OF MILK AND PER CENT. OF FAT, EACH COW, EACH MONTH OF EACH LACTATION.  
*Shorthorn.*

	BETSEY 10TH.				LADY SPENCER.			
	FIRST PERIOD.		SECOND PERIOD.		FIRST PERIOD.		SECOND PERIOD.	
	Milk yield.	Per cent. fat.	Milk yield.	Per cent. fat.	Milk yield.	Per cent. fat.	Milk yield.	Per cent. fat.
Lactation begun.....	4th.	.....	8th.	.....	1st.	.....	2d.	.....
First month.....	587.0	4.56	67.0	4.55	548.0	3.68	708.6	5.64
Second month.....	687.1	4.16	886.6	4.45	610.8	3.90	1088.8	4.85
Third month.....	650.6	3.94	941.1	4.63	493.8	4.03	966.4	4.73
Fourth month.....	581.6	3.87	782.9	4.53	361.9	4.35	880.9	3.95
Fifth month.....	486.5	3.95	816.6	4.63	388.9	4.30	748.7	3.73
Sixth month.....	463.7	4.72	693.0	4.72	345.0	3.90	610.3	3.60
Seventh month.....	437.8	4.45	632.2	4.75	302.7	4.15	603.8	4.06
Eighth month.....	445.3	4.45	584.2	4.45	267.7	4.27	.....	.....
Ninth month.....	411.8	5.01	577.9	4.50	261.9	4.15	.....	.....
Tenth month.....	709.4	4.80	696.6	4.55	235.4	4.35	.....	.....
Eleventh month.....	.....	.....	.....	.....	267.5	4.10	.....	.....
Twelfth month.....	.....	.....	.....	.....	197.3	4.00	.....	.....
Thirteenth month.....	.....	.....	.....	.....	173.9	4.80	.....	.....
Fourteenth month.....	.....	.....	.....	.....	148.5	5.45	.....	.....
Fifteenth month.....	.....	.....	.....	.....	10.6	5.15	.....	.....
Total yield.....	5538.7	.....	6008.1	.....	4480.8	.....	5790.5	.....
Average.....	.....	4.571	.....	4.579	.....	4.385	.....	4.309
Lactation ended.....	31st.	.....	31st.	.....	7th.	.....	31st.	.....

TABLE 69. NUMBER OF DAYS AND DAILY MILK YIELD IN SUCCESSIVE PERIODS OF LACTATION.  
(Continued from Twelfth Annual Report.)

Breed.	NAME OF COW.	FIRST PERIOD.		SECOND PERIOD.		THIRD PERIOD.		FOURTH PERIOD.		FIFTH PERIOD.	
		Number of days.	Average yield, pounds.	Number of days.	Average yield, pounds.	Number of days.	Average yield, pounds.	Number of days.	Average yield, pounds.	Number of days.	Average yield, pounds.
Ayrshire	Miss Floy 6th.....	327	14.71	365	14.57	309	20.48	314	20.04	*173	27.99
	Ayrshire.....	373	18.32	393	22.02	324	24.43	303	24.99	.....	.....
	Junetta Belle.....	431	13.35	330	22.96	360	25.08	*154	23.45	.....	.....
	Ayrshire Peerless.....	460	20.61	315	22.72	.....	.....	.....	.....	.....	.....
	Queen Duchess.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Average.....		.....	16.70	.....	22.57	.....	23.51	.....	22.79	.....	27.99
Guernsey	Rosette Ford.....	704	11.56	443	17.37	.....	.....	.....	.....	.....	.....
	Ortolo.....	723	15.03	406	16.37	*948	25.48	.....	.....	.....	.....
	Stella Select.....	413	15.75	361	15.87	+113	17.23	.....	.....	.....	.....
	Madam Select.....	296	13.23	363	14.35	.....	.....	.....	.....	.....	.....
	Average.....	.....	13.67	.....	15.94	.....	21.26	.....	.....	.....	.....
Jersey	Gilderbloom.....	534	9.94	392	12.22	565	14.16	.....	.....	.....	.....
	Countess Flavia.....	540	14.35	367	14.53	319	14.77	.....	.....	.....	.....
	Barbara Allen.....	566	12.68	365	14.89	331	19.08	*197	21.33	.....	.....
	Albert's Carol.....	534	13.23	331	13.35	.....	.....	.....	.....	.....	.....
	Average.....	.....	12.91	.....	13.75	.....	16.28	.....	19.20	.....	.....
American Holderness	Kelle 6th.....	360	11.00	316	14.06	271	11.35	.....	.....	.....	.....
	Maggie 6th.....	460	13.44	318	19.30	291	20.38	*174	22.77	.....	.....
	Nora.....	*318	19.30	.....	.....	.....	.....	.....	.....	.....	.....
	Average.....	.....	14.73	.....	16.98	.....	16.00	.....	22.77	.....	.....
	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Holstein-Friesian	East 2d.....	733	18.20	295	19.65	.....	.....	.....	.....	.....	.....
	.....	233	18.70	381	21.9	.....	.....	.....	.....	.....	.....
	Teina Aris.....	.....	.....	*19	26.08	.....	.....	.....	.....	.....	.....
	Netherland Constance.....	531	24.05	.....	.....	.....	.....	.....	.....	.....	.....
	Average.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....

† Died before completion of period.

\* Calculated to November 1, 1894, only.

NUMBER OF DAYS AND DAILY MILK YIELD IN SUCCESSIVE PERIODS OF LACTATION — (Concluded).

Breed.	NAME OF COW.	FIRST PERIOD.		SECOND PERIOD.		THIRD PERIOD.		FOURTH PERIOD.		FIFTH PERIOD.	
		Number of days.	Average yield, pounds.	Number of days.	Average yield, pounds.	Number of days.	Average yield, pounds.	Number of days.	Average yield, pounds.	Number of days.	Average yield, pounds.
Holstein-Friesian	Beauty Pledge.	569	16.43	399	28.46	.....	.....	.....	.....	.....	.....
Holstein-Friesian	Ruth.	336	19.46	.....	.....	.....	.....	.....	.....	.....	.....
Average		.....	19.50	.....	26.34	.....	24.81	.....	.....	.....	.....
Devon	Ione.	416	11.11	274	14.40	1167	21.08	.....	.....	.....	.....
Devon	Genevieve's Gift.	437	9.81	806	13.16	.....	.....	.....	.....	.....	.....
Devon	Daydream B.	361	7.98	.....	.....	.....	.....	.....	.....	.....	.....
Devon	Artalia.	459	12.67	364	13.74	2328	7.97	.....	.....	.....	.....
Average		.....	10.27	.....	13.77	.....	14.37	.....	.....	.....	.....
Shorthorn	Betsy 10th.	511	13.68	2940	22.03	.....	.....	.....	.....	.....	.....
Shorthorn	Lady Spencer.	448	10.04	2771	25.37	.....	.....	.....	.....	.....	.....
Average		.....	11.81	.....	23.69	.....	.....	.....	.....	.....	.....
General average of all breeds.		.....	14.23	.....	18.73	.....	19.40	.....	23.59	.....	23.59
General average of all animals.		.....	14.60	.....	18.66	.....	19.06	.....	.....	.....	.....

\* Calculated to November 1, 1894, only.

† Died before completion of period.

TABLE 70. RELATION OF FAT IN FOOD TO FAT IN MILK — FIRST PERIOD OF LACTATION.

Breed.	NAME OF COW.	Butter extract in food.	Pure fat in food.	Fat in milk.	Percent of pure fat in food to fat in milk.	Pure fat in food between 1st & 3d periods.	No. of months.
		Pounds.	Pounds.	Pounds.			
Holstein-Friesian	Esel 2d	586.6	484.5	436.7	111.3	23.4	19
Holstein-Friesian	Beauty Pledge	593.7	490.4	310.7	157.8	21.3	18
Holstein-Friesian	Netherland Constance	634.6	534.2	480.0	134.8	7.1	19.5
Holstein-Friesian	Ruth	231.8	243.7	184.2	181.8	0.5	10.5
Ayrshire	Queen Duchess	441.3	364.9	367.9	99.2	15.3	16
Ayrshire	Junietta Peerless	334.3	266.2	179.5	148.3	.....	15
Ayrshire	Manton Belle	386.3	277.7	230.4	130.5	2.0	13
Ayrshire	Miss Floss 8th	356.6	246.0	232.8	109.9	4.5	13
Ayrshire	Gilderbloom	378.9	313.0	293.0	106.8	.....	17
Jersey	Countess Flavia	485.5	401.0	477.0	84.1	9.7	19
Jersey	Barbara Allen	472.4	390.2	496.7	89.3	.....	16
Jersey	Nellie 6th	519.7	439.3	404.1	106.3	4.7	18
American Holderness	Maggie 6th	283.2	191.8	14.5	131.8	29.5	13
American Holderness	Nora	333.9	276.8	230.1	135.3	54.3	16
American Holderness	Rosette Ford	271.0	233.8	239.5	97.1	.....	10.6
Guernsey	Orlole	585.0	438.3	447.0	108.1	.....	23.5
Guernsey	Madam Select	634.5	516.8	577.8	89.3	.....	24
Guernsey	Stella Select	232.1	183.6	153.7	119.4	.....	8.4
Devon	Ione	464.8	383.9	330.8	119.7	18.5	14.8
Devon	Genevieve's Gift	360.8	253.6	201.9	125.1	8.3	14
Devon	Arctalia	270.1	227.2	206.5	110.0	57.7	12
Devon	Daydream B.	489.3	403.3	368.1	160.4	36.9	18
Shorthorn	Beesey 10th	254.7	210.4	149.7	140.6	.....	13
Shorthorn	Beesey 10th	556.8	459.1	307.8	149.1	80.7	17
Shorthorn	Lady Spencer	514.0	434.6	164.7	239.9	6.1	15.3
	Totals	10480.8	8664.1	7190.4	.....	.....	.....

\* Calculated to November 1, 1894, only.

TABLE 71. RELATION OF FAT IN FOOD TO FAT IN MILK — SECOND PERIOD OF LACTATION.

Breed.	NAME OF COW.	Either extract in food.	Pure fat in food.	Fat in milk.	Per cent. of pure fat in food to fat in milk.	Pure fat in food between 2d and 3d periods.	No. of months.
		Pounds.	Pounds.	Pounds.			
Holstein-Friesian	Ezel 2d.....	541.2	447.0	282.3	188.3	.....	13
Holstein-Friesian	Toisma Artis.....	438.4	390.5	283.8	187.1	39.6	12.8
Holstein-Friesian	Beauty Pledge.....	396.9	2.0	319.9	84.4	.....	7.7
Holstein-Friesian	Netherland Constance*.....	141.9	117.2	194.3	84.4	.....	4.3
Ayrshire	Queen Duchess.....	396.3	337.3	290.8	125.5	.....	11.5
Ayrshire	Junietta Peerless.....	419.1	346.9	234.8	147.4	.....	11
Ayrshire	Manton Belle.....	393.7	316.1	239.3	137.9	19.6	10
Ayrshire	Miss Flow 5th.....	330.6	254.8	135.4	148.8	9.5	13
Jersey	Glitterbloom.....	365.0	301.5	237.4	117.1	26.0	13
Jersey	Countess Flavia.....	333.4	2.9	295.6	84.6	3.8	11.5
Jersey	Barbara Allen.....	4.4	243.5	278.1	128.1	2.7	12
Jersey	Albert's Carol.....	274.8	237.0	259.0	87.6	6.7	11
American Holderness	Nellie 6th.....	301.0	248.6	155.4	160.0	33.8	10.5
American Holderness	Maggie 6th.....	367.1	303.2	231.3	131.1	20.5	10.5
Guernsey	Rosette Ford.....	516.3	425.6	484.0	100.4	.....	15
Guernsey	Ortole.....	438.3	381.9	386.5	83.2	12.9	13.5
Guernsey	Madam Select.....	375.7	310.3	314.0	96.8	.....	11.5
Guernsey	Stella Select.....	338.7	317.4	296.6	90.3	1.7	12
Devon	Ione.....	323.1	296.9	178.5	149.5	23.5	9.5
Devon	Genevieve's Gift.....	292.0	216.4	214.9	100.7	.....	10
Shorthorn	Artalia.....	293.5	317.7	168.3	137.0	.....	9
Shorthorn	Betsy 10th*.....	347.3	317.7	241.0	84.1	.....	11
Shorthorn	Lady Spencer*.....	305.6	282.4	294.2	85.8	.....	9
	Totals.....	8180.3	6756.6	5951.7	.....	.....	.....

\* Calculated to November 1, 1894, only.

TABLE 72. RELATION OF FAT IN FOOD TO FAT IN MILK—THIRD PERIOD OF LACTATION.

Breed.	NAME OF COW.	Either food. Pounds.	Pure fat in food. Pounds.	Fat in milk. Pounds.	Per cent. of pure fat in food to fat in milk.	Pure fat in food and 4th periods.	No. of months.
Holstein-Friesian	Tolama Artis	485.2	400.8	966.9	180.2	.....	12
Ayrshire	Miss Flow 5th	406.7	335.9	222.6	151.0	90.0	10
Ayrshire	Manton Belle	469.3	366.8	312.9	123.6	11.6	12
Ayrshire	Junetta Peerless	398.7	320.3	318.5	103.4	7.5	12
Jersey	Gilderbloom	476.2	393.3	457.0	86.0	.....	19
Jersey	Countess Flavia	343.5	283.7	289.8	97.9	12.7	10.7
Jersey	Barbara Allen	362.5	291.2	353.4	82.4	5.3	11
American Holderness	Maggie 6th	315.3	260.4	281.5	112.5	36.9	9.5
American Holderness	Neille 6th	312.0	175.1	115.8	151.2	.....	9
Devon	Ionet	186.1	153.9	169.0	94.4	.....	5.5
Devon	Artalia*	167.5	138.4	78.6	176.1	.....	7.6
Guernsey	Oricle*	248.0	204.8	301.1	68.0	.....	8.3
Guernsey	Stella Select	113.9	94.1	90.5	104.0	.....	3.8
	Totals	4173.9	3446.7	3800.6	.....	.....	.....

\* Calculated to November 1, 1904, only.

† Died before completion of period.

TABLE 73. RELATION OF FAT IN FOOD TO FAT IN MILK — FOURTH PERIOD OF LACTATION.

Breed.	NAME OF COW.	Ether extract in food.	Pure fat in food.	Fat in milk.	Per cent. of pure fat in food to fat in milk.	Pure fat in food between 4th and 5th periods.	No. of months.
Ayrshire .....	Miss Flow 5th .....	Pounds. 380.7	Pounds. 297.9	Pounds. 244.2	122.0	15.5	10.5
Ayrshire .....	Manton Belle .....	318.7	263.2	235.0	99.3	.....	10.5
Ayrshire .....	Junietta Peerless* .....	169.3	139.8	164.1	85.2	.....	5
Jersey .....	Countess Flavia .....	299.5	247.1	380.5	68.5	.....	11.5
Jersey .....	Barbara Allen* .....	307.8	171.6	212.8	80.6	.....	6.5
American Holderness .....	Maggie 6th* .....	169.2	131.5	164.7	79.8	.....	6
	Totals .....	1515.1	1361.1	1411.3	.....	.....	.....

\* Calculated to November 1, 1894, only

TABLE 74. GENERAL RESULTS—FIRST PERIOD OF LACTATION.

Breed.	NAME OF COW.	Weight at beginning of 1st period.	Total amount of milk.	Total crude fat in food.	Total fat in milk.	Weight at end of 1st period.
Holstein-Friesian	Ezel 2d	958	1798.0	9484.5	586.6	1196
Holstein-Friesian	Beauty Pledge	873	1873.2	6785.8	593.7	1069
Holstein-Friesian	Netherland Constance	869	1482.2	6693.5	594.6	1018
Holstein-Friesian	Ruth	1054	1685.9	5794.1	593.8	184.2
Ayrshire	Queen Duchess	778	1043.3	5679.9	441.8	862
Ayrshire	Junietta Peerless	743	800.2	4017.9	322.3	877
Ayrshire	Manton Belle	976	804.4	3959.0	336.2	1105
Ayrshire	Miss Flow 5th	736	694.7	3531.7	296.6	869
Jersey	Gliderbloom	770	975.6	4855.4	478.9	907
Jersey	Countess Flavia	945	1183.0	5871.6	485.5	794
Jersey	Barbara Allen	831	1164.1	5554.5	477.0	691
American Holderness	Albert's Carol*	819	1142.9	5183.1	493.7	754
American Holderness	Nellie 6th	756	601.9	2987.9	324.2	641
American Holderness	Maggie 6th	777	932.9	4005.7	333.9	691
Guernsey	Norset	832	630.9	3308.7	240.1	917
Guernsey	Rosette Ford	881	1432.5	7015.9	371.0	945
Guernsey	Orfide	690	1482.5	7184.9	586.0	945
Guernsey	Madam Select*	735	483.9	2129.1	183.7	776
Guernsey	Stella Select*	756	835.0	4068.8	380.8	868
Guernsey	Loae	718	908.1	4068.8	301.9	919
Deron	Genevieve's Gift	815	733.4	3553.4	308.9	994
Deron	Aradia	814	1073.1	5641.0	486.2	994
Deron	Daydream B.	988	184.9	3816.5	192.7	1016
Shorthorn	Peddy 10th	1020	1324.3	5837.7	586.8	1016
Shorthorn	Lady Spencer	1120	1118.6	5436.3	514.0	1846
Averages		889	992.9	4949.4	419.0	931

\* Weight upon arrival at station.

† Calculated to November 1, 1894, only.

TABLE 75. GENERAL RESULTS — SECOND PERIOD OF LACTATION.

Breed.	NAME OF COW.	Weight at be- ginning of 2d period.	Total amount milk in food.	Total carbohy- drates in food.	Total crude fat in food.	Total fat in milk.	Weight at be- ginning of 2d period.
Holstein-Friesian.	Peel 2d.	1196	1196.0	5408.1	541.2	263.3	1094
Holstein-Friesian.	Tolsma Artis.	1045	1093.7	5430.8	436.4	228.2	1094
Holstein-Friesian.	Beauty Pledge.	1069	779.1	4076.6	336.9	319.9	1094
Holstein-Friesian.	Netherland Constance.	1018	841.9	1905.4	141.9	134.3	1094
Ayrshire.	Queen Duchess.	892	833.9	4444.8	396.3	390.8	1094
Ayrshire.	Junietta Peerless.	877	861.1	4198.4	4 9.1	324.8	1094
Ayrshire.	Manton Belle.	1106	778.6	4045.3	382.7	259.3	1094
Ayrshire.	Miss Flow 8th.	899	802.0	4118.1	330.6	185.4	1094
Jersey.	Gliderbloom.	907	776.5	3774.5	366.0	267.4	1094
Jersey.	Countess Flavia.	794	775.8	3861.1	316.4	236.6	1094
Jersey.	Barbara Allen.	891	864.3	4181.4	414.6	278.1	1094
Jersey.	Nellie 6th.	764	643.8	33 8.9	274.8	259.0	1094
American Holderness.	Maggie 6th.	841	688.4	3353.5	301.0	156.4	1094
American Holderness.	Rosette Ford.	917	1068.1	5107.4	516.3	231.3	1094
Guernsey.	Ortolo.	945	9 5.9	4546.5	438.2	388.5	1094
Guernsey.	Madam Select.	775	840.8	3911.6	376.7	314.0	1094
Guernsey.	Stella Select.	768	868.1	3835.8	383.7	290.9	1094
Devon.	June.	968	711.8	3339.7	383.1	173.5	1094
Devon.	Genevieve's Gift.	766	643.6	2710.6	262.0	214.9	1094
Devon.	Artalia.	894	643.4	2706.6	363.5	158.9	1094
Shorthorn.	Bersey 10th.	1066	765.5	3277.6	317.3	241.6	1094
Shorthorn.	Lady Spencer.	1845	765.5	3766.3	306.6	294.9	1094
Averages	Averages	936	768.6	3670.3	365.7	266.7	901

\* Calculated to November 1, 1894, only.

TABLE 76. GENERAL RESULTS — THIRD PERIOD OF LACTATION.

Breed.	NAME OF COW.	Weight after calving at be- ginning of 3d period.	Total albumin in food.	Total carbohy- drates in food.	Total crude fat in food.	Total fat in milk.	Weight after calving at end of 3d period.
Holstein-Friesian .....	Tolama Artis .....	1094	1103.3	5186.8	485.2	286.9	1300
Ayrshire .....	Miss Flow 5th.....	917	850.2	4104.2	406.7	222.6	937
Ayrshire .....	Manton Belle .....	1064	1033.7	4775.0	468.3	312.9	1077
Ayrshire .....	Junietta Peerless.....	882	843.7	4237.1	393.7	318.5	898
Jersey .....	Gliderbloom .....	897	1030.5	5121.2	476.2	467.0	.....
Jersey .....	Countess Flavia.....	1778	783.2	3535.1	843.5	289.8	763
Jersey .....	Barbara Allen .....	875	733.4	3740.7	352.5	353.4	916
Guernsey.....	Stella Select* .....	733	381.5	1423.2	113.9	90.5	.....
Guernsey.....	Ordel* .....	884	619.4	2926.5	246.0	301.1	.....
American Holderness .....	Maggie 6th.....	863	636.9	3173.5	315.3	231.5	911
American Holderness .....	Nellie 6th.....	848	499.3	3001.8	212.0	115.8	.....
Devon .....	Ione* .....	936	375.7	1689.4	185.1	162.0	.....
Devon .....	Artallat* .....	1041	410.7	2162.8	167.5	78.6	.....
	Averages .....	910	709.3	3896.5	321.0	246.2	940

\* Died before completion of period.

† Calculated to November 1, 1894, only.

TABLE 77. GENERAL RESULTS -- FOURTH PERIOD OF LACTATION.

Breed.	NAME OF COW.	Weight at calving at beginning of 4th period.	Total albumin- ates in food.	Total carbohy- drates in food.	Total crude fat in food.	Total fat in milk	Weight after calving at end of 4th period.
Ayrshire .....	Junietta Peerless* .....	898	417.7	2196.8	169.2	164.1	.....
Ayrshire .....	Manton Belle .....	1,077	782.6	3989.1	318.7	285.0	.....
Ayrshire .....	Miss Flow 5th. ....	987	761.4	3980.7	360.7	244.2	956
Jersey .....	Countess Flavia. ....	788	705.6	3821.3	299.5	360.5	.....
Jersey .....	Barbara Allen* .....	916	536.7	2611.0	507.8	212.8	.....
American Holderness .....	Maggie 6th* .....	911	404.1	1927.6	159.2	164.7	.....
	Averages .....	920	596.5	3026.1	253.5	235.2	.....

\* Calculated to November 1, 1894, only.

### Some Points from Feeding Milch Cows.

The following table presents certain results secured by 14 feeding experiments concluded during the first three years with from two to four cows in each experiment, the average length of each experiment being 49 days.

The details of these feeding trials are presented by the first assistant in his report, to which reference for all detail is directed.

In each of these experiments the animals included were all in a good flow of milk.

As will be seen by consulting the following table, nearly every detail is grouped together for convenience of reference and at the bottom is presented the general average of all the experiments for a single cow, and in this final average the digestible food of each kind is calculated to this average cow weighing 916.7 pounds.

A general study of the results presented here together will make the detailed study of the several experiments the more interesting and instructive.

It will be seen that the average number of pounds of food digested daily was 13.71 and that the average number of pounds of milk constituents (fat, casein and sugar) produced daily amounted to 3.60 pounds and, therefore, there was required 3.76 pounds of digested food for each pound of milk solids produced; also that for the production of one pound of fat in milk there was an average expenditure of 16 pounds of digestible food.

In the expenditure of energy over and above that needed in the production of milk, there was a daily average sufficient to raise the temperature of the entire cow 80° F. or raise 407.4 pounds of water from 32° to 212° F.

As an average of all the experiments it appears that the fat produced in the milk was 11.9 per cent. in excess of the fat digested in the food; that the casein produced in the milk was but 38.5 per cent. of the protein digested in the food, while the non-nitrogenous matter digested in the food was nearly five and one-half (5.45 per cent.) times greater than that produced in the milk.

It will be seen that in the case of these animals, when the production of fat was approximately at its best, that the digested fat of their food was nearly sufficient to meet the demand.

By reference to tables 70, 71, 72, 73 it will be seen that as the result of four years' experiment with our seven breeds of cattle, we have as follows:

	Pounds.
Crude fat in food fed.....	24,358
Pure fat in food fed (82.6 per cent.) .....	20,119
Pure fat in food between lactation.....	631
Fat in milk.....	<u>17,754</u>

From which it will appear that there was consumed by these various animals 16.9 per cent. more fat than was produced by them in their milk.

## GENERAL RESULTS OF FOURTEEN FEEDING EXPERIMENTS WITH COWS GIVING MILK.

NUMBER OF COWS.	Aggregate live weight.	Number of days in the exp-ri-ment.	Protein in food, pounds.	Fat in food, pounds.	Fiber in food, pounds.	Nitrogen free extract in food, pounds.	Total dry matter in foods daily, pounds.	Digestible protein, 1,000 pounds live weight.	Digestible fat, 1,000 pounds live weight.	Digestible fiber, 1,000 pounds live weight.	Digestible N, free ext., 1,000 lbs live weight.	Total digestible matter in foods daily, pounds.	Total calories in food daily.	Nutritive ratio.	Average milk yield daily, pounds.	Per cent. fat in milk.	Per cent. casein in milk.	Per cent. sugar in milk.	Fat in milk daily, pounds.	Casein in milk daily, pounds.	Sugar in milk daily, pounds.
Four .....	3347.0	92	12.12	4.35	16.72	26.33	73.86	9.08	8.66	10.98	30.51	45.36	1094.2	4:20.9	67.71	15.89	14.60	19.75	2.63	2.47	3.34
Three .....	2642.8	46	7.83	2.42	10.68	30.43	54.66	6.24	2.12	8.20	16.08	36.16	84803	3:18.1	48.59	11.44	10.62	14.89	1.85	1.73	2.48
Three .....	2620.8	45	8.49	2.28	11.61	31.90	57.62	6.65	1.81	7.88	23.79	42.13	89333	3:17.8	44.41	12.43	11.33	14.53	1.84	1.68	2.15
Three .....	2660.8	61	7.71	3.82	14.19	32.72	62.05	6.08	2.94	9.50	26.57	38.76	90806	3:21.4	62.78	11.57	9.38	17.69	2.42	1.99	3.70
Two .....	1716.0	31	4.95	2.51	9.61	22.02	41.92	4.06	1.96	6.46	18.54	26.63	62383	2:15.2	40.89	7.53	6.49	10.67	1.54	1.33	2.18
Three .....	2660.5	45	8.30	3.81	13.55	35.17	65.00	6.33	3.03	8.78	27.69	40.66	92322	3:21.5	58.19	10.57	9.46	16.28	2.06	1.85	3.16
Four .....	3750.7	60	11.40	4.46	17.59	41.84	80.24	8.01	3.26	10.84	39.70	48.58	100460	4:24.7	92.80	17.56	15.45	20.50	4.06	3.59	4.76
Two .....	1899.8	31	6.90	2.39	10.03	22.45	43.17	5.12	1.73	6.32	17.81	28.32	61650	2:11.0	46.66	8.46	7.62	10.33	2.06	1.85	2.51
Two .....	1859.6	30	6.74	3.21	10.69	24.99	46.46	5.08	2.43	6.55	19.81	30.90	68540	2:12.8	44.87	9.14	7.85	10.28	2.05	1.77	2.31
Three .....	2938.5	31	10.10	2.90	14.17	33.49	61.09	6.63	2.11	6.88	23.35	38.39	77427	3:16.9	69.76	13.17	11.36	14.66	3.07	2.62	3.40
Two .....	1968.0	61	6.75	2.06	11.80	28.46	53.14	4.56	1.42	7.19	30.60	33.85	66331	2:13.3	62.70	7.65	7.35	10.49	2.02	1.94	2.76
Three .....	2068.3	62	9.41	3.61	16.74	44.33	78.19	6.49	2.74	10.33	32.65	51.71	103633	3:22.4	80.44	10.93	10.87	15.31	2.93	2.92	4.11
Three .....	2017.7	45	9.43	2.80	14.82	40.89	72.53	7.13	2.06	9.00	26.68	47.10	95016	3:20.6	73.44	11.33	11.18	15.48	2.76	2.74	3.79
Three .....	2018.4	46	8.81	2.43	13.35	35.36	63.82	6.40	1.80	6.76	25.78	39.64	80062	3:19.4	65.10	11.66	11.64	15.36	2.53	2.58	3.33
One .....	916.7	1	2.971	1.069	4.639	11.505	31.444	2.011	.768	2.664	8.128	13.705	39339.1	1:6.4	21.26	3.995	3.639	5.154	.948	.775	1.960

### Relation of Sex in Thoroughbred Calves.

The following inquiry was instituted, not with a purpose to elaborate any theory in addition to the many already advanced in reference to this interesting and practically important matter, but simply to secure, so far as possible, an addition to the many facts which have been already accumulated, leaving them for each to explain as might seem to him best.

A circular was addressed to many breeders of thoroughbred stock of the different breeds, requesting only the order of succession of sex of the calves born to their different animals, and this inquiry was made of such breeders for the reason that only such would have preserved the necessary records.

A very gratifying response was made and the following tables have been compiled from the records sent from 68 herds, including 10 breeds, 769 cows and 3,614 calves.

These records include herds from many of the States and the Canadas.

It may be safely assumed that as a rule any one keeping such records of his herd has maintained his animals in good condition.

It is stated that at the beginning of the last century there were at least 500 different theories as to the causes which determined the sex, and certainly the correspondence in this matter develops the fact that at the present day one or another theory is held by very many of the breeders at the present day.

The following facts will, in a measure, show the results of many attempts to carry one or another of these theories into practice.

The following table gives the number of cows of each breed and the number of calves of each sex in their order from the first to the thirteenth.

In cases where the number of calves is less than that of the cows, as for example, the first calves of the Jerseys, the explanation is that the record was lost of certain cows reported as to her first calf.

Occasional twin calves will also explain the possible excess of calves over the number of cows reported.

It will be observed that only the first four breeds given in the table give data sufficient to be of any value; the others are, however, given in order to get the general average.

After the sixth calf also the data fall off, so that the following are given in order that they may be taken for such value as they may possess in studying the general question.

The table following gives the percentage relations of the facts presented in the first table as to total number of calves of each breed:

NUMBER OF COWS AND NUMBER OF CALVES OF EACH SEX BORN IN ORDER FOR EACH BREED.

No. of cows.	BREED.	1st.		2d.		3d.		4th.		5th.		6th.		7th.		8th.		9th.		10th.		11th.		12th.		13th.	
		Bulls.	Heifers.	Bulls.	Heifers.	Bulls.	Heifers.	Bulls.	Heifers.	Bulls.	Heifers.	Bulls.	Heifers.	Bulls.	Heifers.	Bulls.	Heifers.	Bulls.	Heifers.	Bulls.	Heifers.	Bulls.	Heifers.	Bulls.	Heifers.	Bulls.	Heifers.
254	Jerseys.....	109	138	114	136	107	120	79	86	53	65	39	41	30	38	15	33	17	21	12	19	8	9	3	2	2	2
309	Holstein-Friesians.....	104	97	79	64	88	74	64	77	59	55	42	43	37	27	23	28	14	12	4	14	7	2	3	3	1	1
110	Guernseys.....	67	47	40	53	40	41	21	33	19	22	6	13	8	11	5	8	6	6	6	6	5	1	4	1	1	1
95	Shorthorns.....	53	43	24	33	33	27	20	24	17	15	13	11	11	6	4	5	2	2	1	3	1	2	1	1	1	1
51	Red Polled.....	17	31	22	28	26	27	17	13	14	17	10	17	9	1	4	4	1	1	1	1	2	1	1	1	1	1
21	Ayrshires.....	10	11	7	13	12	7	13	6	8	7	7	6	7	4	4	5	5	5	2	1	1	1	1	1	1	1
10	Galloways.....	5	6	6	4	1	2	3	3	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
6	Aberdeen Angus.....	2	3	2	4	1	6	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
4	Devons.....	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
3	American Holderness.....	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
7	Jersey grades.....	4	3	1	1	1	1	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
760	Totals.....	365	379	398	368	300	307	327	244	172	138	118	123	90	98	57	80	45	44	25	43	18	12	10	7	5	9

## PERCENTAGE RELATIONS OF TOTAL CALVES OF EACH BREED.

Number of cows.	BREED.	Number of calves.	Number of bulls.	Number of heifers.	Per cent. of bulls.	Per cent. of heifers.
254	Jerseys .....	123	583	690	45.8	54.2
209	Holstein-Friesians .....	1040	517	523	49.7	50.3
110	Guernseys .....	451	211	240	46.8	53.2
95	Shorthorns .....	358	180	178	50.3	49.7
51	Red Polled .....	259	118	141	45.6	54.4
21	Ayrshires .....	140	77	63	55.0	45.0
3	American Holderness .....	8	3	5	37.5	62.5
4	Devons .....	8	4	4	50.0	50.0
5	Aberdeen Angus .....	16	7	9	43.8	56.2
10	Galloway .....	33	16	17	48.5	51.5
7	Jersey grades .....	28	14	14	50.0	50.0
769	Totals .....	3614	1730	1884	47.9	52.1

A theory very strongly advanced by certain experimenters, and by some thought clearly proven, is that good nourishment causes a preponderance of females in the offspring.

It will be seen from the foregoing tables that as a total result there was an excess of 8.9 per cent. females over the males, hardly a difference sufficient to establish such theory.

The first calf, apparently, stands an even chance of being male or female, while in the case of the five breeds most numerous reported the chances are that the second calf will be a female, the chances being as 100 to 123.

Another theory which has been widely held is that when the male parent is the elder the male offspring will preponderate. While this view can not be settled by the data presented, it receives little by way of confirmation, since obviously the average age of all the cows reported increases, while no such increase is permitted in the case of the sires. If now we divide the calves into periods of three we shall have:

1st, 2d, 3d.		4th, 5th, 6th.		7th, 8th, 9th.		10th, 11th, 12th, 13th.	
Males.	Females.	Males.	Females.	Males.	Females.	Males.	Females.
963	1054	517	549	198	217	58	64
Per cent.		Per cent.		Per cent.		Per cent.	
47.7	52.3	48.5	51.5	46.9	53.1	47.5	52.5

The above shows a very slight increase in the percentage of females, with an increase in the age of the cows.

### The Individuality of the Cow as Influencing Offspring.

In the data collected no fact is so prominently indicated as the prepotency of the cow in determining the sex of her offspring. As a rule it is seen that the number of males and females are nearly alike, the latter being in an excess of 8.9 per cent.; but among the returns received many instances point emphatically to the predominating influence of the cow herself.

The following table presents the record of 51 cows distributed among seven different breeds, each one of which shows this with more or less force.

It will be seen that one Jersey cow had in succession seven bull calves and that two other Jersey cows, as also a Holstein-Friesian cow, had in succession each seven heifer calves; that two others had each five bull calves and three others each five heifer

calves, and so on throughout the table, and that these calves were in every case all the calves the cow had.

A following table is of equal interest, as showing the same prepotency as to sex of the cow, where many cases are given showing the great preponderance of one sex or the other in the offspring of many of the cows reported.

TABLE SHOWING CONSTANT SEX IN CALVES FROM SAME COW.

	7. Bull calves.	7. Heifers.	6. Bull calves.	6. Heifers.	5. Bull calves.	5. Heifers.	4. Bull calves.	4. Heifers.	4. Bull calves.	3. Heifers.
Jerseys.....	1	2	...	...	2	3	2	2	6	7
Holstein-Friesian.....	...	1	...	1	...	3	...	2	1	1
Guernseys.....	...	...	...	...	...	1	...	1	1	1
Shorthorns.....	...	...	...	...	...	2	2	1	3	1
Red Polled.....	...	...	...	...	...	3	...	...	...	...
Ayrshires.....	...	...	...	...	...	1	1	...	...	1
Galloway.....	...	...	...	...	...	...	...	1	...	...

It is to be recorded also that in the case of one of the Jersey cows giving in continuous succession seven heifer calves a different sire was used, as also in the case of another Jersey giving in succession seven bull calves. The same was true of a Jersey giving five heifer calves in succession, as also of a Shorthorn cow which gave 11 heifers and only one bull calf, and of still another Shortorn cow which gave nine heifers and but one bull calf. Doubtless many similar cases occurred but those sending replies to the circular failed to call attention to this matter which is certainly of marked interest and value as bearing upon the question of the individual influence of the cow in determining the sex of the offspring.

Table Showing Predominance of One Sex, and by one Red Polled Cow.

Eleven heifers and one bull calf by one Jersey cow.

Nine heifers and one bull calf by two Jersey cows.

Eight heifers and one bull calf by two Jersey cows and by one Holstein-Friesian and by one Red Polled.

Eight heifers and two bull calves by two Jersey cows and by one Holstein-Friesian.

Seven heifers and one bull calf by one Guernsey cow and by one Holstein-Friesian and by one Red Polled.

Six heifers and one bull calf by one Guernsey cow and by one Shorthorn.

Five heifers and one bull calf by two Jersey cows and by one Holstein-Friesian by one Red Polled and by one Guernsey.

Four heifers and one bull calf by one Holstein-Friesian cow and by two Guernsey and by one Shorthorn.

Twelve bulls and one heifer calf by one Shorthorn cow.

Eight bulls and one heifer calf by one Holstein-Friesian cow.

Seven bulls and one heifer calf by one Jersey cow.

Seven bulls and two heifer calves by one Holstein-Friesian cow.

Six bulls and one heifer calf by one Red Polled cow and one Guernsey cow.

Six bulls and two heifer calves by one Jersey cow and one Holstein-Friesian cow.

Five bulls and one heifer calf by two Jerseys and one Red Polled cow.

Five bulls and two heifer calves by one Shorthorn and one Red Polled cow.

Four bulls and one heifer calf by two Holstein-Friesian cows.

### Twin Calves.

In the 68 herds reported, including a record of 769 cows and 3,614 calves, there were recorded 62 twin calves, or 1.72 per cent. of the total number of calves. Of these twins, 27, or 45 per cent. were bull calves, and 33, or 55 per cent., heifers, and 16, or 26.7 per cent., were free-martins.

The distribution of the twins among the several breeds was as follows:

Holstein-Friesian, 11 bulls and heifer, two twin bulls, one twin heifer.

Guernseys, one bull and heifer, two twin bulls, one twin heifer.

Jerseys, one bull and heifer, one twin heifer.

Red Polled, three bulls and heifer, one twin bull and three twin heifers.

Shorthorns, one bull and heifer.

In regard to the bearing of twin calves the same evidence is seen of individuality of the cow, since one of the cows reported had, out of a total of eight, six twin calves, another cow out of a total of nine calves had six twin calves, another out of 12 had four twin calves.

The data is manifestly too limited for other than a hint as to the relative tendency of the several breeds toward twin-bearing, but there would seem to be far less frequency of twins with the Jersey than with the other breeds from which we have fairly good returns. The following table gives the number of calves reported of each breed, the number of twin calves and the per cent. of twins born to each breed:

Number of calves.	BREED.	Number of twins.	Per cent. of twins.
1,040	Holstein-Friesian .....	30	2.9
451	Guernsey .....	12	2.7
1,273	Jersey .....	4	.3
259	Red Polled .....	14	5.4
358	Shorthorns .....	2	.3
140	Ayrshire .....	.....	.....
8	Devons .....	.....	.....
16	Aberdeen Angus .....	.....	.....
33	Galloway .....	.....	.....
8	American Holderness .....	.....	.....

### Experiments in Forcing Vegetables During Winter.

The Station greenhouses will be devoted this winter again to forcing vegetables, growing mushrooms and pot experiments with fertilizers. This experiment in the forcing of green vegetables for the winter market will alone well repay one interested in new departures in agriculture to visit the Station and inspect the results which are there being secured. Last winter between the 13th of December and the 26th of May there were produced in the Station greenhouses aggregating 148 feet in length by 20 feet wide:

Three hundred and twenty-five pounds of mushrooms, 1,056 English cucumbers, 1,100 string beans, 12 $\frac{1}{2}$  dozen lettuce, 114 dozen radish, 410 $\frac{1}{2}$  pounds of tomatoes.

Many of these were actually sold at the following prices in the market of Geneva: Mushrooms, \$1 per pound; English cucumbers, 50 cents each; string beans, 40 cents per 100; lettuce, 40 cents per dozen; radish, 4 cents per bunch; tomatoes, 50 cents per pound.

It is the opinion of many who have inspected the above results that they can be produced at great profit even at much lower prices than those given above. At present the houses are again filled with the above vegetables. An accurate record is kept of every detail connected with the methods, extent and expense of production, and these results are now being prepared for a bulletin, and are to be found detailed in the report of the horticulturist in this volume. That this comparatively new industry in this country is attracting wide attention is evidenced by the many visitors who daily inspect the work.

Several have availed themselves of the opportunity to inform themselves in the many important details necessary to success in this branch of work, and with note-books in hand have spent days in the houses under the practical instruction of the gardener in charge of this work. It is worthy of note that these were grown at that season of the year when ordinarily the ordinary farmer is at leisure.

While the mushroom is generally admitted as a great delicacy for the table, and commands a high price as such, it is not so well understood as it should be that it stands exceptionally high among vegetable products for its nutritive value and in its content of nitrogenous matter is only surpassed by lima beans.

Analyses made of mushrooms grown at the Station show them to contain an average of 5.2 per cent of nitrogenous matter, and for comparison the average of several classes of food material are given from the report of the Storrs Agricultural College for 1891, in which it will be found that there was present the following average percentages of albuminoids:

In 5 kinds of fresh meat .....	14.6 per cent.
In 23 kinds of fresh fish .....	10.00 per cent.
In 2 kinds of fresh poultry .....	15.6 per cent.
In 16 kinds of fresh vegetables .....	1.3 per cent.

It will be seen, therefore that, upon an average, mushrooms contain four times as much nitrogenous matter as the average of vegetables, half as much as the average of fresh fish, over a third as much as the average of fresh meats, and one-third as much as the average of poultry, so that not only is the mushroom to be counted as a delicacy for the table, but as possessing a very high nutritive value also.

#### ANALYSES OF MUSHROOMS GROWN AT THE STATION.

	Large.	Small.	FRESH.	
			Small.	Large.
Moisture . . . . .	91.80	90.33	91.80	90.33
Dry matter.				
Ash . . . . .	12.37	11.96	1.014	1.157
Total nitrogen . . . . .	9.43	9.30	.773	.899
Albuminoid nitrogen . . . . .	5.01	5.34	.411	.516
Amide nitrogen . . . . .	4.42	3.96	.362	.383

It will be seen that about half of the nitrogen appears to be present in some other form than as albuminoid.

#### Sugar in Cornstalks.

In 1893 average samples from three varieties of the stalks of sweet corn, from which the ears had been plucked for the canning factory at Geneva, were secured for analysis, and the following results were obtained :

#### ANALYSES OF JUICES.

VARIETY.	Specific gravity.	Per cent. sugar.	Per cent. glucose.
Egyptian . . . . .	1.049	6.88	2.72
Stowell's Evergreen . . . . .	1.065	9.44	2.72
Hickok's . . . . .	1.067	10.09	2.32

In the fall of 1894 average samples of stalks of two of these varieties were again taken for analysis, with the following results:

VARIETY.	Specific gravity.	Per cent. sugar.	Per cent. glucose.
Stockwell's Evergreen .....	1.056	8.90	2.26
Hickok's .....	1.055	8.59	1.96

The average weight of these stalks in 1893, after the ears had been removed, was 21.2 ounces, and after the tops and blades had been removed, 13.6 ounces. In 1894 the average weight of the stalks was, after removal of the ears, 18 ounces, and after the removal of blades and tops it was 12.3 ounces. Allowing the corn to be planted in hills four feet by four and four stalks in a hill, the weight of topped and stripped stalks per acre would have been, in 1893, 9,257 pounds, and in 1894, 8,372 pounds. For purposes of comparison the following results are given as the average for four years from the juices of sugar cane grown in Louisiana: Sugar, 10.67 per cent.; glucose, 1.73 per cent. It will be seen, therefore, that for the production of syrup, which would take both sugars, the cornstalk juice contained as the average of the two years 11.18 per cent., or 90 per cent. of that present in the sugar cane juice, and, since many hundreds of acres of corn are being grown for canning purposes, it seems to be quite worth while to attempt the manufacture of syrup from the stalks, especially since the begasse left after having expressed all the juice which could be secured by a mill, would be excellent material for use in the silo, in this way utilizing every portion of this crop.

#### Analyses of Bean Straw, Stalks and Pods.

- A — Bean straw, from pea beans.
- B — Bean straw, from red kidney bean.
- C — Bean stalks.
- D — Bean pods of red kidney bean.

## Air-dried Samples.

	A.	B.	C.	D.
Moisture .....	8.9	8.6	9.7	11.1
In dry samples:				
Ash.....	7.36	6.86	4.73	5.98
Fat.....	1.03	1.06	1.34	0.63
Crude fiber .....	36.27	34.10	51.05	29.59
Total nitrogen as albuminoids..	7.31	7.38	5.06	3.81
True albuminoids.....	5.31	6.31	4.00	3.00
Invert sugar .....	1.28	0.77	1.89	0.38
Sucrose.....	0.10	0.97	0.46	0.22
Starch .....	10.20	12.40	8.80	13.20
Total nitrogen .....	1.17	1.18	0.81	0.61
Albuminoid nitrogen.....	0.85	1.01	0.64	0.48
Amide nitrogen .....	0.32	0.17	0.17	0.13
Potash .....	25.50	21.25	22.34	34.21
Phosphoric acid .....	2.53	4.41	4.2	2.22

## Branch Station in Second Judicial Department.

The last Legislature appropriated, in accordance with the following law, \$8,000 to be expended under the direction of this Station in agricultural investigations and the dissemination of agricultural knowledge in the Second Judicial Department of New York State, including the counties of Orange and Dutchess and the counties southward, excepting New York:

## LAWS OF NEW YORK, CHAPTER 675.

An act to amend the Agricultural Law in relation to agricultural experiment stations within this State, and to make an appropriation therefor.

Became a law May 12, 1894, with the approval of the Governor. Passed, three-fifths being present.

SECTION 3. The sum of eight thousand dollars, or so much thereof as may be necessary, is hereby appropriated out of any money in the treasury not otherwise appropriated, to be paid to the New York State Agricultural Experiment Station at Geneva, for the purpose of agricultural experiments, investigations, instruction and information, in the second judicial department, pursuant to section eighty-five of the Agricultural Law, and the sum of eight thousand dollars, or so [much thereof as may be necessary, is hereby appropriated out of any moneys in the

treasury, not otherwise appropriated, to be paid to the agricultural experiment station at Cornell University, for the purpose of horticultural experiments, investigations, instruction and information, in the fifth judicial department, pursuant to section eighty-seven of the Agricultural Law. Such moneys shall be paid by the Treasurer upon the warrant of the Comptroller, upon vouchers approved by the Commissioner of Agriculture.

§ 4. This act shall take effect immediately.

By special request of representative agriculturists of this section the investigations undertaken the past season in accordance with the provisions of this law have been concerned with the insect pests of truck crops and testing various kinds of machines for applying insecticides and fungicides. Some of the results of this work are published in the following-named bulletins, which are free, and may be obtained by applying to Dr. Peter Collier, director, Geneva, N. Y. Bulletin No. 74 is entitled "Observations on the Application of Insecticides and Fungicides." No. 75 is on Insects Injurious to Squash, Melon and Cucumber Vines; the Asparagus Beetle." No. 83 is on "Late Cabbage Insects."

A most important discovery that has been made by the entomologists, incidental to their work, is the presence of the San José scale, not before found within the limits of New York State. Mr. Howard, entomologist of the United States Department of Agriculture, states that it is known as the worst insect pest of deciduous fruit trees on the Pacific coast. In view of the serious nature of this new pest, and the importance of preventing, if possible, its distribution to other parts of the State, it is proposed to test methods of fighting it during the coming winter and spring. Early spring will give the best opportunity for studying some of the most serious insect pests of field crops, namely, the asparagus beetle, onion maggot and onion thrips, and early cabbage insects; also the cucumber and potato flea beetles and a dipterous larva affecting spinach, beets and probably other vegetables of a similar nature. The summer's work will be a continuation, largely, of that begun in the spring, together with a special study of the squash vine borer, common melon louse and boreal lady-bird beetle, which is very destructive to squash and pumpkin vines.

### The Climate of Geneva.

During the past 12 years meteorological observations have been taken at the Station, and annually published in the reports, and it has appeared desirable, now that a reasonable time has passed, to gather together the results of these observations and determine the average climatic conditions at the Station in order that our results in the field may be more intelligently understood.

I am indebted to the courtesy of Professor W. R. Brooks, of the Smith Observatory, for the following particulars as to the geography of Geneva: Smith Observatory, which is nearly upon a line with the southern boundary of the Station farm, is in latitude  $42^{\circ} 52' 45''$  and longitude  $2'$  east from Washington, D. C., and 5h. 8m. 00.04s. west from Greenwich, nearly due north of Washington. The Station is located 175 feet above Seneca lake, and the lake is 567 feet above the sea level.

The Station farm, of 130 acres, slopes gently to the south, and generally commands a favorable easterly and southerly exposure. The soil varies from a clay loam at the north to heavier clay along the southern portion.

There are certain facts which these records establish of great practical interest, and which, perhaps, are not as clearly understood as their importance demands.

We find, during the seven months of the year when the soil temperature records have been taken, that the average soil temperature from 1 inch to 24 inches in depth for each month closely approximates the average air temperature for the same month as follows:

MONTHS.	Average soil temperature	Average air temperature.
	Degrees	Degrees.
April .....	44.3	45.6
May .....	55.4	57.9
June .....	66.8	68.7
July .....	69.6	72.8
August .....	69.4	69.1
September .....	64.0	61.9
October .....	54.0	48.9
Average .....	60.5	60.7

We find also that there is approximate uniformity in the average temperature of the soils for these seven months at the different depths observed, as follows:

Average temperature for seven months.

At 1 inch.	2 inch.	3 inch.	6 inch.	9 inch.	12 inch.	18 inch.	24 inch.
62.3°	61.1°	61.5°	60.1°	59.3°	59.0°	61.3°	59.4°

The average rainfall at the Station for twelve years has been 27.73 inches, with a maximum of 36.88 and a minimum of 22.29, but generally it has been uniform, and as will be seen by Table 78, very uniformly distributed. During the seven months, April to October, inclusive, the average rainfall has been 2.86 inches per month, and during the 12 years of observation there have been but two years in April, May and September, and but one year in October when the rainfall has been less than one inch. During the 12 years the average precipitation during the months November to March, inclusive, has been 1.47 inches per month, with a maximum of 1.77 and a minimum of 1.21 inches.

During the 10 years of observation, as will be seen by reference to Table 79, the average sunshine record for the seven months, April to October, inclusive, has shown 45.7 per cent. of possible sunshine, *i. e.*, during these months the sun, while above the horizon, has been obscured by cloud a little more than one-half the time, the maximum sunshine having been 54.5 per cent. of possible, and the minimum 38.8 per cent. During the five months, November to March, inclusive, the average of possible sunshine has been 27 per cent., with a maximum of 33.7 and a minimum of 19.1 per cent. of the possible.

It will be seen that we are favored especially by having the sunshine as also the rainfall when it is most needed for our crops.

The average of the standard air thermometer (see Table 81), gives for 10 years, for the months April to October, inclusive, an average temperature of 60.7° F., while for the months November to March, inclusive, the average has been 28.9° F.

Table 82 gives the monthly average from April to October, inclusive, of soil temperatures at 7 A. M., 12 M. and 6 P. M., for different depths and for 12 years. Also in same table the general daily average for each depth and each month.

It will be observed that the average daily observations taken at 12 M. is higher for depths of one and two inches than the

observations at 6 P. M., but at depths of three inches and more the 6 P. M. observations are the highest of the day, and this is true whatever the month of observation.

It will be seen, also, that at depths of 18 and 24 inches the temperatures are constant throughout the day, and this whichever month is considered.

While the general daily average of all the months is nearly the same for each depth, it is found that there is a general increase, though slight, in the temperatures as we compare the greater with the less depths.

If we compare the average monthly temperatures for the months April to October, inclusive, of the air with the soil thermometers of different depths we find an interesting and important fact indicated as follows:

		Average air thermometer.	Average soil thermometer.
		Degrees.	Degrees.
For seven months.....	1 inch .....	60.7	62.3
For six months .....	2 inches .....	58.7	60.3
For five months.....	3 inches .....	58.8	60.2
For two months.....	6 inches .....	55.4	57.4
For two months.....	9 inches .....	55.4	57.2
For three months.....	12 inches .....	60.0	62.4
For three months.....	18 inches .....	60.0	64.0
For two months.....	24 inches .....	55.4	65.0

The excess of temperature after a depth of three inches was found in the months of August, September and October, thus showing that in the latter portion of the season a large reserve of heat has been stored up in the soil, modifying greatly the severity of the winter and permitting probably a root development which otherwise could not go on at the lower temperature of the air.

TABLE 78. PRECIPITATION BY MONTHS SINCE 1882.

YEARS.	January.		February.		March.		April.		May.		June.		July.		August.		September.		October.		November.		December.		Total.	
	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.
1882	0.48	1.44	0.98	1.56	4.45	3.69	2.42	2.37	1.30	0.62	0.92	0.62	0.92	0.62	0.92	0.62	0.92	0.62	0.92	0.62	0.92	0.62	0.92	0.62	8.89	0.56
1883	1.88	2.01	2.54	0.83	2.49	2.01	2.33	3.47	2.12	2.10	1.54	1.54	2.10	1.54	1.54	2.10	1.54	1.54	2.10	1.54	1.54	2.10	1.54	1.54	2.10	0.73
1884	1.07	0.61	0.13	1.36	1.68	2.49	4.64	5.02	1.44	1.67	1.07	1.07	1.67	1.07	1.07	1.67	1.07	1.07	1.67	1.07	1.07	1.67	1.07	1.07	1.67	0.97
1885	1.13	0.96	1.13	4.13	1.92	2.53	4.41	2.86	2.31	2.88	3.44	3.44	2.88	3.44	2.86	2.31	2.88	3.44	2.88	3.44	2.86	2.31	2.88	3.44	1.34	1.34
1886	0.16	2.87	0.48	1.37	0.46	2.01	6.37	3.01	0.75	1.74	1.58	1.58	1.74	1.58	1.58	1.74	1.58	1.58	1.74	1.58	1.58	1.74	1.58	1.58	1.74	1.34
1887	0.78	1.04	1.43	3.09	2.9	3.68	0.99	4.03	2.73	3.47	2.02	2.02	3.47	2.02	4.03	2.73	3.47	2.02	4.03	2.73	3.47	2.02	4.03	2.73	3.47	1.34
1888	2.99	0.35	0.64	3.28	1.31	7.47	4.57	1.96	3.50	3.3	3.3	3.3	4.57	1.96	1.96	3.50	3.3	3.3	4.57	1.96	1.96	3.50	3.3	3.3	4.57	1.34
1889	2.16	1.45	2.16	2.16	5.49	5.36	1.07	4.34	6.81	4.54	2.40	2.40	4.54	2.40	4.34	6.81	4.54	2.40	4.54	2.40	4.34	6.81	4.54	2.40	4.54	1.34
1890	1.44	1.57	3.25	1.61	0.49	4.31	3.95	3.16	0.47	2.65	0.74	0.74	3.16	0.47	3.16	0.47	2.65	0.74	3.16	0.47	2.65	0.74	3.16	0.47	3.16	0.74
1891	0.57	0.88	0.15	0.67	4.04	3.95	1.89	4.77	1.13	1.74	1.74	1.74	4.77	1.13	4.77	1.13	1.74	1.74	4.77	1.13	1.74	1.74	4.77	1.13	4.77	0.73
1892	1.63	3.71	1.94	2.69	4.94	3.03	3.68	5.36	2.68	1.69	1.69	1.69	5.36	2.68	5.36	2.68	1.69	1.69	5.36	2.68	1.69	1.69	5.36	2.68	5.36	1.09
1893	2.31	2.7	1.26	3.43	7.03	1.77	1.50	1.33	1.33	3.59	0.43	0.43	1.33	3.59	0.43	1.33	3.59	0.43	1.33	3.59	0.43	1.33	3.59	0.43	1.33	0.47
1894	2.99	3.71	3.35	4.13	7.03	7.47	6.37	5.36	5.36	4.54	3.48	3.48	5.36	4.54	5.36	4.54	3.48	3.48	5.36	4.54	3.48	3.48	5.36	4.54	3.48	3.48
Maximum	0.48	0.61	0.13	0.67	0.46	1.77	0.99	1.33	0.47	0.62	0.43	0.43	0.62	0.43	0.62	0.43	0.43	0.43	0.62	0.43	0.43	0.43	0.62	0.43	0.43	0.43
Minimum	1.37	1.61	1.37	2.09	3.07	3.61	3.11	3.31	2.44	2.38	1.77	1.77	2.38	1.77	2.38	1.77	2.44	2.38	2.38	1.77	1.77	2.38	1.77	2.38	1.77	1.31
Average	1.37	1.61	1.37	2.09	3.07	3.61	3.11	3.31	2.44	2.38	1.77	1.77	2.38	1.77	2.38	1.77	2.44	2.38	2.38	1.77	1.77	2.38	1.77	2.38	1.77	1.31

TABLE 79. MONTHLY SUMMARY OF SUNSHINE RECORD, MAY 1, 1885, TO JULY 1, 1894.

	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
1885 Hours.....	43.3	80.0	83.3	144.8	165.2	237.5	284.7	103.5	206.7	184.5	53.2	50.0
Per cent. of possible.....	43.3	80.0	83.3	144.8	165.2	237.5	284.7	103.5	206.7	184.5	53.2	50.0
1886 Hours.....	14.3	26.7	22.3	36.3	235.8	253.2	243.3	240.3	55.3	33.3	18.1	17.6
Per cent. of possible.....	14.3	26.7	22.3	36.3	235.8	253.2	243.3	240.3	55.3	33.3	18.1	17.6
1887 Hours.....	41.0	61.5	110.7	159.0	235.0	217.8	267.5	235.8	56.7	142.8	104.0	68.5
Per cent. of possible.....	41.0	61.5	110.7	159.0	235.0	217.8	267.5	235.8	56.7	142.8	104.0	68.5
1888 Hours.....	14.5	16.3	90.7	80.9	58.4	207.2	270.9	255.0	157.1	.....	.....	.....
Per cent. of possible.....	14.5	16.3	90.7	80.9	58.4	207.2	270.9	255.0	157.1	.....	.....	.....
1889 Hours.....	65.8	74.5	134.4	164.7	185.2	45.7	63.9	24.8	152.0	105.8	65.4	69.3
Per cent. of possible.....	65.8	74.5	134.4	164.7	185.2	45.7	63.9	24.8	152.0	105.8	65.4	69.3
1890 Hours.....	45.3	64.2	97.0	90.3	150.3	230.8	263.7	194.5	157.3	31.3	32.3	34.3
Per cent. of possible.....	45.3	64.2	97.0	90.3	150.3	230.8	263.7	194.5	157.3	31.3	32.3	34.3
1891 Hours.....	77.8	96.8	155.8	150.7	180.7	230.5	210.3	243.7	230.5	77.6	81.9	12.1
Per cent. of possible.....	77.8	96.8	155.8	150.7	180.7	230.5	210.3	243.7	230.5	77.6	81.9	12.1
1892 Hours.....	73.7	93.2	138.1	170.7	149.1	199.4	273.9	190.5	206.5	143.7	58.4	104.6
Per cent. of possible.....	73.7	93.2	138.1	170.7	149.1	199.4	273.9	190.5	206.5	143.7	58.4	104.6
1893 Hours.....	58.9	50.0	92.9	103.2	154.9	185.3	183.7	41.4	55.3	42.1	41.6	37.0
Per cent. of possible.....	58.9	50.0	92.9	103.2	154.9	185.3	183.7	41.4	55.3	42.1	41.6	37.0
1894 Hours.....	109.3	175.9	184.4	183.4	147.6	294.1	289.7	224.8	143.8	176.8	86.8	31.8
Per cent. of possible.....	109.3	175.9	184.4	183.4	147.6	294.1	289.7	224.8	143.8	176.8	86.8	31.8
Hours.....	64.6	86.0	135.8	160.4	176.0	231.3	275.8	213.1	180.5	188.5	70.9	54.1
Annual average per cent. possible.....	58.1	59.8	33.7	39.5	38.3	48.6	54.5	40.6	48.7	40.5	34.1	19.1

TABLE 80. READING OF MAXIMUM AND MINIMUM THERMOMETERS AT 7 A. M.

YEAR.	JANUARY.		FEBRUARY.		MARCH.		APRIL.		MAY.		JUNE.	
	Maximum.	Minimum.	Maximum.	Minimum.	Maximum.	Minimum.	Maximum.	Minimum.	Maximum.	Minimum.	Maximum.	Minimum.
1883.....	26.2	6.9	23.8	11.9	22.5	14.2	20.5	26.0	22.7	41.3	76.2	22.7
1884.....	26.2	8.8	27.8	19.8	26.7	22.2	49.0	21.7	23.9	43.0	78.9	23.4
1885.....	26.1	11.5	31.8	0.9	27.2	10.2	28.6	27.7	24.9	43.8	74.1	23.0
1886.....	27.0	12.1	31.8	14.5	27.2	23.2	28.2	28.0	25.7	43.7	76.1	22.9
1887.....	26.2	10.2	31.7	14.7	27.0	19.2	28.3	31.4	24.1	50.8	76.5	23.9
1888.....	24.9	8.6	31.1	14.6	27.7	16.7	20.1	31.5	23.7	46.1	77.4	23.6
1889.....	26.0	22.0	26.8	9.2	26.8	26.7	24.3	26.3	23.7	48.1	77.7	23.9
1890.....	26.1	22.2	26.8	9.5	24.6	21.6	24.3	23.2	21.6	43.9	76.0	23.1
1891.....	27.7	19.4	27.0	18.5	24.7	21.2	24.2	23.3	23.6	40.3	77.8	23.2
1892.....	26.7	18.4	27.0	18.0	23.7	19.7	23.8	24.7	20.9	41.7	76.9	22.7
1893.....	27.8	18.7	26.8	11.0	26.8	22.1	21.4	20.7	23.5	44.7	79.1	27.4
1894.....	27.0	22.8	26.8	12.9	26.3	22.4	23.7	26.4	26.9	46.1	77.5	23.1
Average.....	26.0	13.7	31.8	14.1	26.1	20.7	22.0	23.8	29.9	44.9	76.7	23.9

## READING OF MAXIMUM AND MINIMUM THERMOMETERS AT 7 A. M.—(Concluded).

YEAR.	JULY.		AUGUST.		SEPTEMBER.		OCTOBER.		NOVEMBER.		DECEMBER.		AVERAGE.	
	Maximum.	Minimum.	Maximum.	Minimum.	Maximum.	Minimum.	Maximum.	Minimum.	Maximum.	Minimum.	Maximum.	Minimum.	Maximum.	Minimum.
1883 .....	77.1	57.6	75.8	55.0	66.8	45.4	51.8	38.3	48.5	29.7	36.8	18.0	53.4	34.3
1884 .....	76.5	57.4	80.4	57.9	76.3	54.3	60.1	41.0	44.3	28.7	34.3	30.1	55.2	36.8
1885 .....	79.5	59.8	73.7	56.3	67.9	48.6	58.3	40.2	45.5	33.0	35.0	30.5	52.3	24.1
1886 .....	78.7	57.3	77.4	57.5	73.6	51.0	59.3	39.8	44.6	32.0	29.3	15.1	54.7	38.4
1887 .....	85.3	65.4	76.0	56.8	67.6	47.8	56.3	33.0	46.7	38.6	30.7	31.1	54.8	36.7
1888 .....	78.1	55.4	78.1	54.7	67.7	48.6	60.4	37.3	47.4	31.4	35.9	32.6	53.1	35.3
1889 .....	78.8	61.1	76.4	55.5	68.9	50.3	51.6	36.3	46.3	34.2	43.2	27.2	55.5	38.5
1890 .....	80.0	58.9	77.6	57.7	69.1	51.0	56.4	43.3	45.5	39.6	30.0	12.7	55.5	37.7
1891 .....	76.5	56.2	78.5	58.4	77.8	54.5	58.3	38.3	46.7	30.0	43.5	37.4	57.2	38.1
1892 .....	82.3	58.3	79.4	59.4	71.8	50.8	59.3	40.6	43.0	29.7	30.9	19.4	54.7	37.0
1893 .....	81.0	58.6	79.5	59.0	67.6	48.3	63.0	41.9	45.6	30.8	37.1	17.9	54.6	35.9
1894 .....	87.6	60.9	78.3	55.3	76.3	53.5	61.4	43.9	42.4	39.6	38.4	24.5	57.8	39.3
Average .....	80.0	58.9	77.6	56.9	70.9	50.3	57.3	39.8	45.5	20.4	35.4	10.5	54.9	36.7

TABLE 81.  
READINGS OF THE STANDARD AIR THERMOMETER.

YEAR.	JANUARY.			FEBRUARY.			MARCH.			APRIL.			MAY.			JUNE.			JULY.		
	7 A.	12 M.	6 P.	7 A.	12 M.	6 P.	7 A.	12 M.	6 P.	7 A.	12 M.	6 P.	7 A.	12 M.	6 P.	7 A.	12 M.	6 P.	7 A.	12 M.	6 P.
1885.....	30.2	30.6	17.8	9.9	14.8	14.9	17.4	23.5	22.1	37.6	47.5	45.0	50.7	60.8	60.3	60.0	70.2	63.7	66.1	76.7	74.8
1886.....	17.9	21.4	31.0	20.1	21.6	22.2	28.6	33.0	33.0	43.8	53.9	53.6	53.8	62.3	60.2	59.2	71.7	70.0	64.2	75.5	73.2
1887.....	19.2	24.0	32.1	23.5	26.8	25.9	24.3	29.4	28.3	38.4	48.1	44.5	56.4	70.8	67.9	62.3	72.4	71.1	76.7	81.1	79.1
1888.....	16.0	19.9	17.6	21.4	26.2	24.8	22.1	28.4	26.7	37.1	46.4	44.8	50.6	59.2	57.9	63.1	73.7	72.5	63.1	76.1	72.8
1889.....	26.4	31.1	29.8	17.2	22.4	21.1	30.2	37.8	34.8	40.7	51.3	48.6	54.5	65.4	63.5	60.3	62.3	67.1	66.9	76.1	74.1
1890.....	29.5	34.8	33.5	28.5	33.8	37.6	36.0	32.0	30.8	39.8	50.7	49.4	49.1	58.1	56.3	61.8	73.2	70.9	65.9	76.2	73.9
1891.....	25.4	28.7	26.6	26.9	31.7	28.9	27.0	34.3	31.6	42.0	51.4	50.1	49.5	59.7	58.4	62.7	74.0	71.5	64.0	72.7	70.7
1892.....	22.3	25.2	21.5	23.7	29.5	26.5	23.2	30.9	27.6	38.8	48.8	46.8	50.5	58.4	57.2	65.9	73.5	69.9	66.0	78.7	76.4
1893.....	16.1	18.4	17.8	19.7	24.2	22.6	27.4	36.3	31.9	38.0	47.6	44.2	51.3	62.0	58.5	65.6	76.6	72.6	67.6	77.7	73.1
1894.....	27.3	32.5	30.1	17.9	24.5	21.2	40.3	41.1	32.0	43.7	50.4	47.5	52.4	61.9	60.3	60.5	75.1	71.2	67.1	81.6	76.4
Average.....	22.0	25.7	23.7	20.9	26.8	24.0	28.7	32.9	29.9	39.8	49.6	47.4	51.9	61.9	60.0	62.4	73.0	70.6	66.8	77.2	74.4
Mean.....	....	23.8	....	....	23.6	....	....	29.8	....	....	45.6	....	....	57.9	....	....	68.7	....	....	72.8	....

## READINGS OF THE STANDARD AIR THERMOMETER—(Concluded).

YEAR.	AUGUST.			SEPTEMBER.			OCTOBER.			NOVEMBER.			DECEMBER.			YEARLY AVERAGE.			Average from 7 A. M. to 6 P. M. of year.
	7 A. M.	12 M.	6 P. M.	7 A. M.	12 M.	6 P. M.	7 A. M.	12 M.	6 P. M.	7 A. M.	12 M.	6 P. M.	7 A. M.	12 M.	6 P. M.	7 A. M.	12 M.	6 P. M.	
1885.....	61.3	60.6	66.7	60.1	66.1	61.5	43.8	53.7	49.3	37.4	48.6	39.8	37.0	31.3	30.3	40.1	48.1	45.9	44.7
1886.....	63.3	74.4	71.2	66.5	67.7	65.3	45.9	55.4	51.9	33.8	39.9	37.5	30.7	26.9	28.0	48.1	50.8	48.4	47.1
1887.....	61.5	72.8	70.7	58.5	63.0	61.0	42.8	51.3	46.9	34.7	41.1	36.8	26.9	20.8	28.3	45.5	50.9	48.5	47.6
1888.....	63.9	74.6	72.4	63.0	61.6	60.9	40.4	47.5	44.9	37.1	43.6	38.7	27.4	23.0	29.8	41.2	49.3	47.0	45.8
1889.....	61.4	73.0	70.4	55.3	61.5	63.0	39.5	47.8	44.0	37.4	42.9	40.6	34.1	28.7	35.7	43.7	49.8	49.3	47.4
1890.....	63.4	73.4	69.5	55.0	65.7	63.0	45.8	52.9	49.0	35.4	41.2	38.3	19.5	21.7	23.6	45.5	51.3	49.0	47.9
1891.....	63.8	75.1	71.1	59.8	73.5	67.3	45.3	54.5	50.7	35.9	41.1	37.9	33.3	29.1	35.9	44.4	53.0	50.1	49.2
1892.....	64.7	75.9	73.0	56.7	63.3	64.4	45.1	54.9	50.3	34.3	37.8	35.0	23.7	26.1	29.7	43.9	50.8	47.7	47.1
1893.....	61.4	76.0	73.5	54.3	64.7	60.4	46.6	57.5	53.6	34.5	43.2	38.0	25.5	20.1	27.2	42.6	51.1	47.9	47.2
1894.....	60.6	74.9	70.1	53.7	71.6	67.3	47.0	58.0	53.6	33.8	38.1	35.3	20.1	23.9	21.3	44.7	53.6	49.6	49.3
Average.....	62.5	74.0	70.7	57.2	63.3	63.3	44.1	53.4	49.2	35.3	41.0	37.6	26.7	21.6	29.0	41.9	50.8	45.3	47.3
Mean.....	60.1	.....	.....	.....	61.9	.....	.....	46.9	.....	.....	38.0	.....	.....	29.1	.....	.....	47.3	.....	.....

TABLE 82. AVERAGE SOIL TEMPERATURES AT DIFFERENT DEPTHS DURING GROWING SEASON.

AVERAGE FOR TWELVE YEARS.	ONE INCH.			TWO INCHES.			THREE INCHES.			SIX INCHES.		
	7 A. M.	12 M.	6 P. M.	7 A. M.	12 M.	6 P. M.	7 A. M.	12 M.	6 P. M.	7 A. M.	12 M.	6 P. M.
	40.1	51.5	49.6	41.2	50.5	51.3	41.0	47.8	50.2	41.4	43.9	47.7
April .....	51.9	62.5	61.1	52.5	61.5	62.0	52.0	59.5	60.8	52.7	55.4	58.9
May .....	63.6	75.3	72.7	63.1	74.3	72.9	63.0	71.6	73.0	63.3	66.9	70.2
June .....	66.5	79.1	76.3	69.6	70.0	69.4	66.3	75.1	76.3	64.8	70.6	74.1
July .....	64.1	75.7	73.0	64.2	73.5	73.7	64.6	72.1	74.1	65.7	63.8	72.8
August .....	57.7	68.0	65.9	57.7	67.0	66.3	58.3	65.4	66.7	59.9	63.5	65.6
September .....	47.0	54.0	51.8	47.4	53.2	52.0	48.6	52.9	52.9	50.3	52.1	53.3
October .....	55.8	66.8	64.3	55.1	64.3	63.9	56.3	63.5	64.9	57.1	60.0	63.2
Average .....	47.1	58.5	57.7	47.7	58.7	58.7	48.3	57.4	58.7	55.7	55.7	58.7
April .....	70.9	74.0	74.0	70.1	70.1	69.2	69.2	72.5	72.5	70.5	70.5	70.5
May .....	70.9	70.9	70.5	70.5	70.5	70.3	70.3	70.3	70.3	68.9	68.9	68.9
June .....	63.9	63.9	63.7	63.7	63.7	63.5	63.5	63.5	63.5	63.7	63.7	63.7
July .....	50.9	50.9	50.9	50.9	50.9	51.5	51.5	51.5	51.5	51.9	51.9	51.9
August .....	62.3	62.3	61.1	61.1	61.1	61.5	61.5	61.5	61.5	60.1	60.1	60.1
September .....												
October .....												
Average .....												

## AVERAGE SOIL TEMPERATURES, ETC. — (Concluded).

AVERAGE FOR TWELVE YEARS.	NINE INCHES.			TWELVE INCHES.			EIGHTEEN INCHES.			TWENTY-FOUR INCHES.		
	7 A. M.	13 M.	6 P. M.	7 A. M.	12 M.	6 P. M.	7 A. M.	12 M.	6 P. M.	7 A. M.	12 M.	6 P. M.
April.....	42.3	42.7	45.2	40.3	38.9	41.8	45.5	43.5	45.6	40.3	40.3	40.4
May.....	53.4	53.9	55.8	52.4	51.3	53.7	55.9	56.8	56.0	50.4	50.3	50.5
June.....	63.9	64.9	67.5	64.6	64.9	66.1	66.4	66.1	65.6	61.4	61.4	61.4
July.....	67.8	68.4	71.6	67.4	67.4	69.2	70.2	70.0	70.2	65.9	65.9	66.1
August.....	66.5	67.8	70.2	66.1	67.7	70.5	69.8	69.7	69.8	67.3	67.1	66.9
September.....	61.2	61.8	64.1	63.8	62.9	64.7	65.4	65.6	65.4	63.8	63.8	63.5
October.....	51.3	51.8	52.6	53.4	54.6	56.0	56.9	56.8	56.7	57.7	57.6	57.4
Average.....	58.1	58.8	61.0	58.6	58.0	61.7	61.3	61.2	61.3	58.1	58.1	58.1
April.....	.....	43.4	.....	.....	39.7	.....	.....	45.5	.....	.....	40.3	.....
May.....	.....	54.4	.....	.....	53.5	.....	.....	55.9	.....	.....	50.4	.....
June.....	.....	65.4	.....	.....	65.2	.....	.....	66.4	.....	.....	61.4	.....
July.....	.....	69.3	.....	.....	68.0	.....	.....	70.1	.....	.....	66.0	.....
August.....	.....	68.2	.....	.....	69.1	.....	.....	69.8	.....	.....	67.1	.....
September.....	.....	62.4	.....	.....	63.5	.....	.....	65.5	.....	.....	67.1	.....
October.....	.....	51.9	.....	.....	54.7	.....	.....	56.8	.....	.....	61.7	.....
Average.....	.....	59.3	.....	.....	59.0	.....	.....	61.3	.....	.....	59.4	.....

## Commercial Fertilizers.

### THE NEW YORK STATE FERTILIZER LAW.

#### CHAP. 437.

An Act for the protection and education of farmers and manufacturers in the purchase and sale of fertilizers.

Approved by the Governor May 24, 1890. Passed, three-fifths being present.

This act was amended by

#### CHAP. 601, LAWS OF NEW YORK.

An Act to amend chapter four hundred and thirty-seven of the laws of eighteen hundred and ninety, entitled "An act for the protection and education of farmers and manufacturers in the purchase and sale of fertilizers."

Became a law May 9, 1894, with the approval of the Governor. Passed, three-fifths being present.

Chapter 437, as amended by Chapter 601, Laws of New York, reads as follows:

Amendments are in italics.

SECTION 1. All commercial fertilizers which shall be offered for sale, to be used in this State, shall be accompanied by an analysis stating the percentages contained therein of nitrogen or its equivalent of ammonia, of soluble and available phosphoric acid, the available phosphoric acid either to be soluble in water or in a neutral solution of citrate of ammonia as determined by the methods agreed upon by the American Society of Agricultural Chemists, and of potash soluble in distilled water. A legible statement of the analysis of the goods *and of the person, firm or corporation who have manufactured the same* shall be printed on or attached to each package of fertilizer offered for sale for use in this State, and where fertilizers are sold in bulk, to be used in this State, an analysis shall accompany the same, with an affidavit that it is a true representation of the contents of the article or articles.

§ 2. Manufacturers residing in this State, and agents or sellers of fertilizers made by persons residing outside the limits of this State, shall between the first and twentieth days of July, in each year, furnish to the Director of the New York State Agricultural Experiment Station at Geneva, a list of the

commercial fertilizers they manufacture or offer for sale for use in this State, with the names or brands by which they are known on the market, and the several percentages of nitrogen or its equivalent of ammonia, of phosphoric acid, *both* soluble and available, and of potash either single or combined, contained in said fertilizer, as called for in section one of this act. Whenever any fertilizer or fertilizing ingredients are shipped or sold in bulk, for use by farmers in this State, a statement must be sent to the Director of the New York State Agricultural Experiment Station at Geneva, giving the name of the goods so shipped, and accompanied with an affidavit from the seller, giving the analysis of such percentage guaranteed.

§ 3. Whenever a correct chemical analysis of any fertilizer offered for sale in this State shall show a deficiency of more than one-third of one per centum of nitrogen or its equivalent of ammonia, or one-half of one per centum of available phosphoric acid, or one-half of one per centum of potash soluble in distilled water, such statements shall be deemed false within the meaning of this act. This act shall apply to all articles of fertilizers offered or exposed for sale for use in the State of New York, the selling price of which is ten dollars per ton or higher, and of which they are part or parcel, and of any element into which they enter as fertilizing materials, among which may be enumerated nitrate of soda, sulphate of ammonia, dissolved bone black and bone black undissolved, any phosphate rock, treated or untreated with sulphuric or other acids, ashes from whatever source obtained, potash salts of all kinds, fish scrap, dried or undried, also all combinations of phosphoric acid, nitrogen or potash, from whatever source obtained, as well as every article that is or may be combined for fertilizing purposes.

§ 4. All manufacturers or dealers exposing or offering for sale in this State fertilizers containing roasted leather or any other form of inert nitrogenous matter shall, in legible print, state the fact on the package in which the fertilizers are exposed or offered for sale.

§ 5. Every person, firm or corporation violating any of the provisions of this act *shall be guilty of a misdemeanor*, and shall upon conviction thereof, for the first offense, be punished by a fine of not less than fifty dollars, nor more than two hundred dollars, and for the second offense by double the amount in the

discretion of the court; such fines to be paid to the officer whose duty it is to enforce the provisions of this act, to be used by him for that purpose, and to be accounted for to the Comptroller.

§ 6. The Director of the New York State Agricultural Experiment Station at Geneva is charged with the enforcement of the provisions of this act, and shall prosecute in the name of the people for violation thereof; and for that purpose he may employ agents, counsel, chemists and experts, and the court of special sessions shall have concurrent jurisdiction to hear and determine charges for violating the provisions of this act committed in their respective counties, subject to the power of removal provided in chapter one of title six of the Code of Criminal Procedure.

§ 7. And the said director of the New York State Agricultural Experiment Station at Geneva, or his duly authorized agents, shall have full access, egress and ingress to all places of business, factories, buildings, cars, vessels or other places where any manufactured fertilizer is sold, offered for sale or manufactured. Such Director shall also have power to open any package, barrel or other thing containing manufactured fertilizer, and may take therefrom sufficient samples; and whenever any such fertilizer is so taken for samples it may be divided into different portions and one or more portions sealed in such a way that it can not be opened without upon examination giving evidence of having been opened to the person sealing the same, and delivered to the person from whom said sample is taken, or to any other person that may be agreed upon, by the said Director or his agents who takes the same and the person from whom it is taken, which portion so delivered may upon consent of the parties be delivered to a chemist for the purpose of being analyzed other than the chemist employed by said Director.

§ 8. The sum of twenty thousand dollars, or so much thereof as may be necessary, is hereby appropriated out of any money in the treasury not otherwise appropriated, to be used by said director of the New York State Agricultural Experiment Station at Geneva, as shall be authorized by the Board of Control thereof, in enforcing the provisions of this act. Said sum shall be paid to said Director by the Treasurer, upon the warrant of the Comptroller, upon vouchers to be approved by the Comp-

troller, in such sums and at such times as said Director may require, who shall file a statement for what purposes he desires the same.

§ 9. Agents, representatives or sellers of manufactured fertilizers or fertilizing material made or owned by parties outside of this State and offered for sale or use in this State, shall conform to the provisions of this act and shall be subject to its penalties, and in all particulars shall take the place of their nonresident principals.

§ 10. Chapter two hundred and twenty-two of the laws of eighteen hundred and seventy-eight is hereby repealed.

§ 11. This act shall take effect immediately.

### Wood Ashes.

Numerous letters, accompanied with samples, are addressed to the Station, desiring analyses of the samples in order to determine whether they are in fact, as they are represented to be by the seller "Pure, unleached, Canada, hard wood, ashes."

It is probably true that, during the past 20 years, there has never been a carload of ashes shipped from Canada or elsewhere which corresponds to the above description under which many hundreds of carloads are annually sold and used in this country.

Very many carloads have within the past two or three years been shipped into this State from Canada with the official guarantee that they contained from 4 to 5 per cent. of potash. Twenty-one carloads averaged in guarantee 4.57 per cent. As the average of 24 analyses made at this Station the potash was equal to 5.66 per cent., while the maximum was 8.81 per cent. and the minimum was 3.75 per cent.

In the Massachusetts Report for 1893 analyses are given of 105 samples of wood ashes with the following average results:

	Per cent. potash.	Per cent. phosphoric acid.
Average .....	5.37	1.28
Maximum .....	9.46	3.75
Minimum .....	1.51	.05

In the Connecticut Report for 1893, I find analyses of 19 samples of wood ashes averaging as follows :

	Per cent. potash.	Per cent. phosphoric acid.	Price per ton.
Average .....	4.93	1.61	\$11.38
Maximum .....	7.19	4.86	.....
Minimum .....	2.81	.78	.....

It is clear, therefore, that with such wide variation in the composition of this material, as has been found in Massachusetts, Connecticut and New York, it is impossible to reply to the repeated question as to whether a given sample is "up to standard," for, as has been shown, there is no standard, and should the reply be that any given sample is not unleached, hard wood, ashes, while it would be literally true in every case, it would be often unjust to the seller, who presumes them to be as he represents them. The only way would appear to be that they should be bought only upon a guaranteed analysis, as are other fertilizing materials.

In the Handbook of Experiment Station Work published by the U. S. Department of Agriculture, p. 411, the following percentages of potash and phosphoric acid are given in the ashes of several air-dry woods.

	Per cent. ash.	Per cent. potash.	Per cent. phosphoric acid.
Ash .....	.32	46.04	3.58
Chestnut .....	.16	18.10	6.76
Dogwood .....	.68	28.04	8.51
Hickory .....	.48	28.60	11.97
Oak, post .....	.77	21.92	9.00
Oak, red .....	.57	24.66	10.55
Oak, white .....	.26	42.16	9.48
Pine, Georgia .....	.33	15.35	3.82
Pine, yellow .....	.23	19.70	4.18
Pine, black .....	.21	14.30	4.33
Sycamore .....	.99	23.17	12.23
Average .....	.45	25.64	7.67

It will be seen, therefore, that, as the average of the above analyses, there was found in the air-dry wood approximately one-half of 1 per cent. of ash, and that this ash contained upon an average one-quarter of its weight of potash and one-thirteenth of its weight of phosphoric acid.

In order to determine the results in a manner comparable with actual practice, about an equal weight each of the following varieties of air-dried hard and soft woods were taken, and each lot was burned in a furious fire in an open hearth, with the following results:

Hard woods.	Soft woods.
Elm.	Spruce.
Soft maple.	Pine.
Birch.	Basswood.
Beech.	Hard pine.
Maple.	Hemlock.
Chestnut.	White wood.
White ash.	
Hickory.	
Red oak.	
Cherry.	
White oak.	
Red elm.	
Iron wood.	

The per cent. of ash obtained from the hard woods was .638 and from the soft woods it was .513.

These ashes contained as follows:

	Hard woods, per cent.	Soft woods, per cent.
Total phosphoric acid.....	2.00	2.10
Insoluble phosphoric acid.....	.75	.63
Available phosphoric acid .....	1.25	1.47
Potash .....	13.09	6.94

In order to determine the approximate loss by burning at the high temperature of the hearth, approximately equal quantities of the same woods were taken and incinerated at a very low

temperature and there was found in the ash of the hard woods 17.35 per cent. of potash and in the ash of the soft woods 9.61 per cent. of potash.

From the above results it will be clearly seen that pure, unleached, hard wood, ashes of which we hear so much is an evanescent dream and a fiction, for there is nothing approaching it found in the markets.

While it is probably true that ashes are bought for, and their beneficial effects is mainly due to, the potash they contain, it is clear that the potash is thus obtained at an excessive price as compared with its commercial value in the several potash salts of the German mines, but it must not be forgotten that the other constituents of ashes have an agricultural value, direct or indirect, which may often justify their application even at their present prices and average composition; but it is important for the purchaser to remember that there is really no significance in the term "pure, unleached ashes," and a guaranteed per cent. of potash, as also freedom from any adulteration, should be insisted upon, since it would be an easy matter to increase the percentage of potash by admixture with a sufficient quantity of the cheaper potash salts.

### Analyses of Commercial Fertilizers.

I desire again, in connection with the matter of fertilizer control, to call attention to the emphatic indorsement of the committee of the New York State Grange, especially in reference to this feature of our work at the Station. The New York State Grange annually appoints as one of the standing committees three members to visit and report upon the Experiment Station at Geneva, and at the recent annual meeting of the grange this committee made an extended and highly commendatory report of what they learned during an entire day spent in personal inspection of the work of the Station. In this report they say:

"Your committee would say that, in our opinion, the Station does pay, and pay many, many times over, to the farmers of this State, all that it has ever cost or will cost them. The farmers of this State now purchase commercial fertilizers to the amount of \$4,000,000 annually, and you can readily see that information on

this subject is of vast importance financially. Your committee was impressed with the fact that no other line of Station work has resulted in such an actual and present saving of dollars and cents to the farmers of this State as the analysis of commercial fertilizers. It enables the farmer to buy intelligently, and no manufacturer can long do business whose goods do not come up to his analysis when analyzed at the Station."

In the report of the Chemist analyses will be found of 235 samples of fertilizers, nearly all of different brands, offered for sale in this State in the spring of 1894.

The average composition of these different brands, as found upon analysis, and the maximum and minimum amounts guaranteed of each constituent, is given in the following table:

AVERAGE COMPOSITION OF COMMERCIAL FERTILIZERS, SPRING OF  
1894.

	Per cent.
Nitrogen, maximum amount guaranteed .....	3.597
Nitrogen, minimum amount guaranteed .....	2.827
Nitrogen, amount found by analysis .....	3.021
Available phosphoric acid, maximum amount guaranteed ....	10.149
Available phosphoric acid, minimum amount guaranteed ....	7.992
Available phosphoric acid, amount found by analysis .....	8.334
Total phosphoric acid, maximum amount guaranteed .....	13.000
Total phosphoric acid, minimum amount guaranteed .....	12.325
Total phosphoric acid, amount found by analysis .....	12.943
Potash, maximum amount guaranteed .....	5.00
Potash, minimum amount guaranteed .....	4.905
Potash, amount found by analysis .....	5.317

The maximum amount guaranteed of the nitrogen and available phosphoric acid is 27 per cent. greater than the minimum amounts guaranteed, and the maximum amount of potash is 16 per cent. greater than the minimum amounts guaranteed. This is a very considerable difference; but, as has been already shown, is very misleading to the purchaser, since there really is no guarantee at all above the minimum amount, and yet of the entire number of brands analyzed there are but 14 which do not give maximum and minimum amounts. This matter will be referred to again.

TRADE VALUES OF FERTILIZING INGREDIENTS IN RAW MATERIALS  
AND CHEMICALS, ADOPTED BY EXPERIMENT STATIONS.

	1898.	1894.
	Cents per p. und.	Cents per pound.
Nitrogen in ammonia salts.....	17	19
Nitrogen in nitrates .....	15½	14½
Organic nitrogen in dry and fine ground fish, meat and blood, and in high-grade mixed fertilizers ..	17½	18½
Organic nitrogen in cotton-seed meal and castor pomace.....	16½	15
Organic nitrogen in fine ground bone and tankage.	15	16½
Organic nitrogen in fine ground medium bone and tankage .....	12	15
Organic nitrogen in medium bone and tankage ....	9	12
Organic nitrogen in coarse bone and tankage.....	7	7
Organic nitrogen in hair, horn shavings and coarse fish scraps .....	7	7
Phosphoric acid, soluble in water.....	6½	6
Phosphoric acid soluble in ammonium citrate ....	6	5½
Phosphoric acid in fine bone and tankage.....	6	5½
Phosphoric acid in fine medium bone and tankage..	5	4½
Phosphoric acid in medium bone and tankage.....	4	3
Phosphoric acid in coarse bone and tankage.....	3	2
Phosphoric acid in fine ground fish, cotton-seed meal, castor pomace and wood ashes .....	5	5
Phosphoric acid insoluble in ammonium citrate, in mixed fertilizers.....	2	2
Potash as high-grade sulphate, in forms free from muriates (chlorides) in ashes, etc .....	5½	5
Potash in muriate .....	4½	4½

Of the fertilizers analyzed there were 179 brands, of which the selling price to consumers was ascertained, and of these 179 the following table gives the average composition as found by analysis, the maximum and minimum guarantee, and the average price to the farmer :

	Per cent.
Nitrogen, maximum amount guaranteed .....	3.507
Nitrogen, minimum amount guaranteed.....	2.753
Nitrogen, amount found by analysis.....	2.942
Available phosphoric acid, maximum amount guaranteed....	10.137
Available phosphoric acid, minimum amount guaranteed....	8.059
Available phosphoric acid, amount found by analysis .....	8.333

	Per cent.
Total phosphoric acid, maximum amount guaranteed .....	12.509
Total phosphoric acid, minimum amount guaranteed .....	10.221
Total phosphoric acid, amount found by analysis.....	10.830
Potash, maximum amount guaranteed .....	5.576
Potash, minimum amount guaranteed.....	4.862
Potash, amount found by analysis.....	5.279
Average selling price to farmers .....	\$32 25

If we consider the amount of nitrogen, phosphoric acid and potash found as in each case 100, the following will show the relative amounts in the minimum and maximum guarantees of each constituent:

Nitrogen.....	100	119.2	93.6
Available phosphoric acid.....	100	121.6	96.7
Total phosphoric acid.....	100	115.5	94.4
Potash.....	100	105.6	92.1
Average .....	100	115.5	94.2

It will be seen that this year, as has been shown also heretofore, the manufacturers appear to be able to keep much nearer to their minimum guarantees, since upon an average they exceed the former only 5.8 per cent., while they fall short 15.5 per cent. in maintaining the maximum guarantee.

If we estimate the average value of their fertilizers, allowing even maximum prices for the several constituents, as  $18\frac{1}{2}$  cents per pound for nitrogen,  $5\frac{1}{2}$  cents for available phosphoric acid, 2 cents for insoluble phosphoric acid, and  $4\frac{1}{2}$  cents for potash, we find the average fertilizer to be worth as follows, per ton of 2,000 pounds:

58.8 pounds nitrogen at $18\frac{1}{2}$ cents.....	\$10.88
166.7 pounds available phosphoric acid at $5\frac{1}{2}$ cents .....	9.17
49.9 pounds insoluble phosphoric acid at 2 cents.....	1 00
105.6 pounds potash at $4\frac{1}{2}$ cents .....	4 75
Total.....	\$25.80

The average selling price of these 179 brands was \$32.25 per ton, \$6.45, or 25 per cent., above the average valuation of these goods.

Recent quotations show that potash as high-grade muriate can be landed in Geneva, by the ton, at not exceeding  $4\frac{1}{4}$  cents per pound, and nitrogen as nitrate of soda, at  $15\frac{1}{2}$  cents per pound, and soluble phosphoric acid at 5 cents per pound.

At these prices our average fertilizer would cost \$21.77 per ton instead of \$25.80, and there would be a saving of \$10.48 per ton, which would well pay for the cost of mixing.

This matter of the possible saving to the farmer in the cost of the commercial fertilizers which he uses is urged upon his attention, not because there is reason to think he is being defrauded by manufacturers and dealers, for, conducted as this great industry is, there is reason to believe that the necessary expenses attending the business are so numerous and in the aggregate so great that the apparent difference between the first cost to the manufacturer and the price at which the product reaches the consumer dwindles to a very narrow margin of actual profit.

But while it is obvious that there is room for a very considerable saving in cost provided a few enterprising farmers unite and mix their own fertilizers, there is, in such a course, reason to believe that a far greater intelligence will soon be manifest in the study of the general principles underlying this question of the use of fertilizers. Besides, also, the farmers who buy their raw fertilizing constituents and mix them will be certain as to the character of the mixture which they use and able, therefore, the more intelligently to determine whether its results justify its continued use or appear to demand a modification.

At the present time potash salts, muriate, sulphate or kainit of various degrees of purity, sulphate of ammonia, nitrate of soda, superphosphates, ground bone, dried blood, fish scrap and tankage, can be bought as readily and with as little danger of fraud as can salt, soap or sugar, but this is by no means true of the so-called mixed fertilizers found in the market, since the manufacturers are unwilling to place confidence in their customers and tell them what they have to sell. It would seem that this policy would at once cause every one making mixed fertilizers to prepare their own, even were they to do so at greater cost rather than at a saving.

To-day anyone who may desire can buy in quantity powdered leather, horn and hoof meal and many other products of like character, the fertilizing value of which is, to say the least, ques-

tionable, but what prominent manufacturer is willing to acknowledge that he uses either of the above as an ingredient of one or another of the several brands of fertilizers he may be placing upon the market? It was but recently that a farmer handed me a fragment of a roasted hoof, which in its present condition had by chance got into the fertilizer which he had bought. With this evidence who can doubt but that the nitrogen present in this particular fertilizer was supplied wholly or in part from this material, the agricultural value of which is, with our present knowledge, so uncertain, who can doubt that while the above enumerated and probably worthless materials can be found so abundantly in our markets, that there is a large though secret demand for them, and that this demand comes from some of the manufacturers of commercial fertilizers.

The law of this State does not forbid the use of leather or anything else by the manufacturers, but in the case of "roasted leather or any other form of inert nitrogenous matter," it shall be the duty of the manufacturer or dealer to state the fact in legible print on the package in which the fertilizers are exposed or offered for sale. (See section 4 of the Fertilizer Law.) Such fact, so far as I know, has not been stated upon any brand of fertilizer offered for sale in this State.

Certain manufacturers appear unwilling to state their formulas for compounding their several products, as though there was some great secret hidden beneath, revealing which would seriously injure their trade. Now and then we hear in discussion about the wonderful virtue of "well-balanced formulas, etc., etc.," the absurdity of which claim can be easily established by a few illustrations taken from the fertilizers analyzed and reported in this report.

Among the 235 samples analyzed 41 were of brands mentioned as potato manures. The average selling price of these 41 potato manures was \$35.34 per ton. On the theory that there was something in this well-balanced formula talk, we might reasonably expect to find approximate agreement among these 41 brands, while as a matter of fact we do find that they are subject to widest variation, agreeing in nothing except that in the opinion of all the manufacturers a potato manure should contain all three of the leading fertilizing constituents, viz.: Phosphoric acid, potash and nitrogen.

I give below the average composition of the 41, as also the maximum and minimum percentages of each constituent.

	Nitrogen, per cent.	Available phosphoric acid, per cent.	Potash, per cent.
Average of 38 .....	3.32	5.37	6.45
Maximum .....	5.69	10.74	11.58
Minimum .....	1.53	4.84	2.36

It will be seen that the maximum and minimum of nitrogen in these 41 samples varies as 100 to 372, the available phosphoric acid as 100 to 222, and the potash as 100 to 492.

The same fact appears in reference to the special tobacco manures, of which there were eight reported and analyzed.

	Nitrogen, per cent.	Available phosphoric acid, per cent.	Potash, per cent.
Average of 8 .....	2.89	8.25	4.64
Maximum .....	6.21	9.83	11.19
Minimum .....	2.04	3.50	2.38

As with the several potato specials, here too we find wide variation, in the nitrogen varying as 100 to 304, the available phosphoric acid as 100 to 281, and the potash as 100 to 470.

One more illustration will only serve to emphasize the absurdity of this often presented claim.

There were 12 special cabbage fertilizers analyzed and the average selling price of the 12 was \$36.88. The average analysis and variations of these are given below :

	Nitrogen, per cent.	Available phosphoric acid, per cent.	Potash, per cent.
Average of 12 .....	4.61	6.69	7.03
Maximum .....	7.92	8.19	11.16
Minimum .....	2.89	4.97	3.16

Here again we find the nitrogen in these 12 varying as 100 to 274, the available phosphoric acid as 100 to 164, and the potash as 100 to 353.

### The Mixing of Fertilizers.

The following represent the average prices of the best fertilizing materials, per ton of 2,000 pounds, in the city of New York during the fall of 1894:

Nitrate of soda, 96 per cent. pure, containing 15.81 per cent. of nitrogen, \$46; equal to 14.55 cents per pound for nitrogen.

Sulphate of ammonia, 95.25 per cent. pure, containing 20.2 per cent. of nitrogen, \$74; equal to 18.07 cents per pound for nitrogen.

Muriate of potash, 81.5 per cent. pure, containing the equivalent of 51.46 per cent. of potash, \$40; equal to 3.89 cents per pound for potash.

Sulphate of potash, 92.5 per cent. pure, containing 50 per cent. potash, \$16.25, equal to 4.625 cents per pound for potash.

Acid phosphate, containing 15 per cent. soluble phosphoric acid, \$12.75, equal to 4.25 cents per pound for soluble phosphoric acid.

The above constitute the very highest grades, and the most expensive fertilizing materials in our markets.

Lower grades of muriate and sulphate of potash and of acid phosphates can be obtained at prices which would considerably reduce the cost per pound of potash and phosphoric acid; also in place of the expensive nitrate and ammonia salts, fish scrap, tankage, dried blood and other forms of nitrogenous compounds could be used, thereby very appreciably reducing the cost.

Let us suppose that we desire from the above chemicals to mix several fertilizers representing the average analyses given of the 235 fertilizers analyzed, also one having the average composition of the 41 potato manures, also another having the composition of the average of the eight tobacco manures, and finally one with the average composition of the 12 cabbage manures.

These average analyses are as follows:

		Nitrogen, per cent	Phosphoric acid, per cent.	P. ash, per cent.
1	Average of 235 fertilizers.....	3.02	8.33	5.32
2	Average of 41 potato fertilizers ...	3.22	5.37	6.45
3	Average of 8 tobacco fertilizers ...	2.89	8.25	4.64
4	Average of 12 cabbage fertilizers..	4.61	6.69	7.03

It will be seen that 2,000 pounds of each must contain as follows:

		Nitrogen, pounds.	Phosphoric acid, pounds.	Potash, pounds.
1	Average of 235 fertilizers.....	60.4	166.7	106.3
2	Average of 41 potato fertilizers ...	64.4	107.4	129.0
3	Average of 8 tobacco fertilizers ...	57.8	165.0	92.8
4	Average of 12 cabbage fertilizers..	92.2	138.8	140.6

In order that the nitrogen may not be wholly as nitrate and in danger of being in part lost before it is demanded by the growing crop, we will supply half in the form of nitrate of soda and half as ammonia sulphate.

In the tobacco manure we will supply the potash in the form of sulphate.

In order to supply the necessary amounts of the fertilizing constituents given in the above table it will be necessary to take as follows:

POUNDS.	Average of 235 fer- tilizers.	Average of 41 potato fertilizers.	Average of 8 tobacco fertilizers.	Average of 12 cabbage fertilizers.
Nitrate of soda.....	199	203	292	183
Sulphate of ammonia .....	150	160	228	143
Muriate of potash .....	207	251	273	.....
Sulphate of potash.....	.....	.....	.....	186
Acid phosphate .....	1,111	716	892	1,100
	1,667	1,330	1,685	1,612
Plaster.....	333	670	315	388
	2,000	2,000	2,000	2,000

Should one prefer using potash in the form of sulphate in the potato manure, the required 129 pounds would be furnished by 258 pounds of the sulphate in place of the 251 pounds of muriate.

The cost per ton of the four fertilizers mentioned above at the prices already given would be as follows :

	Average of 235 ana- lyzed.	Average of 41 potato manures.	Average of 8 tobacco manures.	Average of 12 cabbage manures.
Nitrate of soda.....	\$4 39	\$4 69	\$4 20	\$6 71
Sulphate of ammonia.....	5 46	5 82	5 22	8 33
Acid phosphate .....	7 09	4 57	7 01	5 69
Muriate of potash .....	4 14	5 02	3 61	.....
Sulphate of potash.....	.....	.....	.....	6 50
Cost per ton .....	\$21 08	\$20 10	\$20 04	\$27 23

To the above there would have to be added about \$3.50 as freight from New York city to the central part of the State, although in car lots the item of freight could be reduced to about \$2.50 per ton.

It will be seen that in each of the fertilizers compounded plaster has been added in order to make up the required 2,000 pounds; in place of this dry earth could be used, although plaster is of itself a desirable fertilizer and adds to the value of the mixture.

If we allow \$3.50 as the cost of freight we have the following average results in selling prices, cost of making and amount saved per ton.

	Selling price.	Cost of making.	Difference
Average of 235 fertilizers.....	\$32 25	\$24 58	\$7 67
Average of 41 potato manures.....	35 34	23 60	11 74
Average of 8 tobacco manures.....	32 33	23 54	8 79
Average of 12 cabbage manures .....	36 88	30 7.	6 15

It is of course to be kept in mind that in the above mixed fertilizers, the preparation of which has been explained, there has been used in every case the very best chemicals to be found in

the market, which chemicals are used but very sparingly, if at all, by the general manufacturer, and that by using the cheaper forms and lower grades for the nitrogen, phosphoric acid and potash required, a very great decrease in the cost of home manufactured fertilizers would result.

The addition of a certain amount of plaster in the four fertilizers compounded above, may seem to give some ground to a very common belief that in the ordinary commercial fertilizers of the market there is generally added some similar material as a "filler," but such view is wholly erroneous and does great injustice to the manufacturers.

It is not unusual to receive letters from those who, having a convenient deposit of peat or muck, are of the impression that such deposit may be made the basis of a fertilizer, and that it is only necessary to add certain compounds containing nitrogen, potash and phosphoric acid, to secure a mixture fully equal to the leading brands of fertilizers found for sale.

By reference to the table giving the amounts of nitrogen, phosphoric acid and potash in the four fertilizers compounded, it will be seen that there was in a ton of each the following:

		Nitrogen, pounds.	Phospho- ric acid, pounds.	Potash, pounds.	Total pounds.
1	Average of 235 fertilizers.....	60.4	166.7	106.3	333.4
2	Average of 41 potato fertilizers..	64.4	107.4	129.0	300.8
3	Average of 8 tobacco fertilizers..	57.8	165.0	92.8	315.6
4	Average of 12 cabbage fertilizers.	92.2	133.8	140.6	366.6

It will be seen that besides these three fertilizing constituents, there would be present in each ton of other matter, of which no account is given in analysis or guarantee, the following number of pounds, viz.: In No. 1, 1,666.6 pounds; in No. 2, 1,699.2 pounds; in No. 3, 1,684.4 pounds; and in No. 4, 1,633.4 pounds, an average of 83.54 per cent. of the total weight of the fertilizers. Or if we consider the composition of these four we shall

find that the total per cent. of nitrogen, phosphoric acid and potash in the four is as follows: In No. 1, 16.67 per cent.; in No. 2, 15.04 per cent.; in No. 3, 15.78 per cent.; and in No. 4, 18.33 per cent., an average of 16.46 per cent., leaving, as we saw above, 83.54 per cent. unaccounted for. But this large excess of comparatively, if not actually, worthless matter is necessitated from the fact that three fertilizing constituents, nitrogen, phosphoric acid and potash, are not to be found as such in the markets, and the manufacturers of fertilizers are forced to rely upon the several commercial products which contain them, also since these products which contain them in largest quantity command relatively the highest market prices, the manufacturer contents himself with those which will serve his purpose in preparing any given brand and which may be bought at relatively the lowest price.

#### Commercial Fertilizers Sold in New York State.

During the last three years an effort has been made to determine the aggregate sales of the different kinds of fertilizing materials annually sold in this State. A circular letter was addressed to the various manufacturers doing business in this State, requesting information as to the aggregate of their sales, and also the quality of the fertilizers sold, in order that information might be obtained as to the relative consumption of phosphoric acid, potash and nitrogen compounds. It is not intended, of course, to make public the details of individual business, but to secure such general information concerning this trade as would appear to be of value to both manufacturers and consumers of these products.

In the main the manufacturers thus addressed have promptly responded to the circular asking for this information. In several cases no replies have been received, while in a few cases a fear has been expressed lest the information thus given might transpire.

To allay any such fear in the future, and in order that no information given in this report can be manipulated in such a way as to enable one manufacturer to approximately estimate the sales of another, it is thought best not to indicate in any way

those manufacturers who have not reported, and to assure those who have done so, that so soon as the sales received from them have been tabulated, every report has been burned so that there does not now exist in possession of the Station any information other than that embodied in the following statement :

**Aggregate Amounts of Fertilizers Reported as Sold in this State During the Year Ending November 1, 1894.**

	Tons.
Number of tons of complete manure for spring use...	39422.7
Number of tons of complete manure for fall use.....	8927.8
Number of tons of ammoniated superphosphates without potash, including dissolved bone, etc., for spring use .....	161.5
Number of tons of ammoniated superphosphates without potash, including dissolved bone, etc., for fall use .....	72.0
Number of tons of ground bone for spring use.....	2850.5
Number of tons of ground bone for fall use .....	2681.8
Number of tons of kainit for spring use.....	287.1
Number of tons of kainit for fall use .....	33.0
Number of tons of muriate of potash for spring use..	233.0
Number of tons of muriate of potash for fall use ....	65.7
Number of tons of nitrogenous matter:	
(a) Ammonium sulphate for spring use.....	13.0
Ammonium sulphate for fall use .....	12.0
(b) Sodium nitrat for spring use.....	79.0
Sodium nitrat for fall use.....	4.5
(c) Blood, ammonite, etc., for spring use .....	1149.0
Blood, ammonite, etc., for fall use.....	911.0
Number of tons of plain superphosphates, including both dissolved bone black and S. C. acid phosphates for spring use.....	1781.5
Number of tons of plain superphosphates, including both dissolved bone black and S. C. acid phosphates for fall use .....	843.8
<b>Total .....</b>	<b>59528.9</b>

**Names of Manufacturers Offering Fertilizers for Sale in the State During 1894.**

- Acme Fertilizer Co., Maspeth, Queens Co., N. Y.  
Allentown Manufacturing Co., Allentown, Pa.  
Armour & Co., Chicago, Ill.  
H. J. Barker & Brother, 93 William street, New York, N. Y.  
Baltimore Guano Co., Canton, Md.  
Bowker Fertilizer Co., 43 Chatham street, Boston, Mass.  
Bradley Fertilizer Co., Boston, Mass.  
Brown & Gilman, 10 S. Delaware avenue, Philadelphia, Pa.  
E. B. Chapin, Rochester, N. Y.  
Chemical Company of Canton, Baltimore, Md.  
The Chesapeake Guano Co., Baltimore, Md.  
The Chicopee Guano Co., Baltimore, Md.  
Clark's Cove Fertilizer Co., 81 Fulton street, New York, N. Y.  
Cleveland Dryer Co., Cleveland, O.  
E. Frank Coe Co., 16 Burling Slip, New York, N. Y.  
Peter Cooper's Glue Factory, 17 Burling Slip, New York, N. Y.  
Crocker Fertilizer and Chemical Co., Buffalo, N. Y.  
E. A. Cross, North Parma, N. Y.  
Cumberland Bone Phosphate Co., Portland, Me.  
Dambman Brothers & Co., Baltimore, Md.  
Danbury Fertilizer Co., Danbury, Conn.  
L. B. Darling Fertilizer Co., Pawtucket, R. I.  
J. H. Devins, Utica, N. Y.  
J. J. Ellis, Darien Center, N. Y.  
Erie City Fertilizer Works, Erie, Pa.  
John Finster, Rome, N. Y.  
George B. Forrester, 169 Front street, New York, N. Y.  
Great Eastern Fertilizer Co., Rutland, Vt.  
Ira C. Hall, Farmer, N. Y.  
The Hallock & Duryee Fertilizer Co., Mattituck, Suffolk Co., N. Y.  
Isaac C. Hendrickson, Jamaica, Queens Co., N. Y.  
S. M. Hess & Brother, Philadelphia, Pa.  
Hubbard & Co., 10 Light street, Baltimore, Md.  
Imperial Guano Co., Norfolk, Va.  
Lackawanna Fertilizing Co., Moosic, Pa.

- Liebig Manufacturing Co., Carteret, N. J.  
 Listers' Agricultural Chemical Works, Newark, N. J.  
 Lonergan & Livingston, Albany, N. Y.  
 Frederick Ludlam, 108 Water street, New York, N. Y.  
 Mapes Formula and Peruvian Guano Co., 143 Liberty street,  
 New York, N. Y.  
 Maryland Fertilizer and Manufacturing Co., 30 S. Holliday  
 street, Baltimore, Md.  
 Michigan Carbon Works, Detroit, Mich.  
 Miller Fertilizer Co., 206 Buchanan's Wharf, Baltimore, Md.  
 Milsom Rendering and Fertilizer Co., Buffalo, N. Y.  
 Mitchell Fertilizer Co., Tremley, N. J.  
 L. Mittenmaier & Son, Rome, N. Y.  
 Moller & Co., Maspeth, Queens Co., N. Y.  
 Moro Phillips Chemical Co., 131 S. Third street, Philadelphia,  
 Pa.  
 Henry E. Myers, Middletown, N. Y.  
 National Fertilizer Co., Bridgeport, N. Y.  
 Northwestern Fertilizing Co., Union Stock Yards, Chicago, Ill.  
 Oakfield Fertilizer Co., Oakfield, N. Y.  
 Oneonta Fertilizer and Chemical Co., Oneonta, N. Y.  
 Pacific Guano Co., Boston, Mass.  
 A. Peterson, Penfield, N. Y.  
 W. W. Phipps & Co., Albion, N. Y.  
 Pottstown Iron Co., Pottstown, Pa.  
 Preston Fertilizer Co., Green Point, Kings Co., N. Y.  
 The Quinnipiac Co., 83 Fulton street, New York, N. Y.  
 Rasin Fertilizer Co., New York, N. Y.  
 Read Fertilizer Co., New York, N. Y.  
 John S. Reese & Co., Baltimore, Md.  
 Rochester Fertilizer Co., 393 East Main street, Rochester, N. Y.  
 Rogers & Hubbard Co., Middletown, Conn.  
 Samson Fertilizer and Chemical Co., North East, Pa.  
 Lucien Sanderson, New Haven, Conn.  
 Scott Fertilizer Co., Elkton, Md.  
 Isaac Smith, Columbiaville, N. Y.  
 Springfield Fertilizer Co., Springfield, O.  
 Standard Fertilizer Co., Boston, Mass.

- H. Stappenbeck, Utica, N. Y.  
 Sterling Oil Co., Greenport, Suffolk Co., N. Y.  
 Richard H. Stone, Trumansburg, N. Y.  
 F. E. Sturtevant, Hartford, Conn.  
 Swift & Co., Chicago, Ill.  
 I. P. Thomas & Son Co., 2 S. Delaware avenue, Philadelphia, Pa.  
 Ellsworth Tuthill & Co., Promised Land, Suffolk Co., N. Y.  
 George F. Tuthill & Co., Greenport, Suffolk Co., N. Y.  
 The Tygert-Allen Fertilizer Co., 2 Chestnut street, Philadelphia, Pa.  
 J. E. Tygert & Co., 42 S. Delaware avenue, Philadelphia, Pa.  
 Walker Fertilizer Co., Clifton Springs, N. Y.  
 Walker, Stratman & Co., Pittsburg, Pa.  
 Walton, Wann & Co., Wilmington, Del.  
 M. E. Wheeler & Co., Rutland, Vt.  
 P. White & Sons, Barren Island, N. Y.  
 Williams & Clark, 81 Fulton street, New York, N. Y.  
 Williams & Lander, Ardsley, N. Y.  
 Zell Guano Co., Baltimore, Md.

### Gifts to the Station.

#### APPLE.

March 23. Downing & Morris, Clinton, Ind., Wabash Red Winter.

April 5. Mrs. S. T. Paddock, Three Oaks, Mich., wild crab-apple cions.

April 6. J. W. Adam's Co., Springfield, Mass., Walter Pease apple.

April 8. S. C. De Cou, West Moorestown, N. J., ten cions each of Arkansas Black, Mammoth Black Trig and Coffelt.

April 9. Moyer & Cook, Laketon, Ind., Moyer's Prize.

April 21. W. M. Samuels & Co., Clinton, Ky., ten root grafts Aiken apple.

April 27. J. H. Luttenton, East Carlton, N. Y., cions of Carlton.

April 30. B. O. Curtis, Paris, Ill., cions Melting apple, and two Pear Flavor trees.

APRICOT.

April 21. Hoopes Bro. & Thomas, West Chester, Pa., two Japan apricot.

BLACKBERRY.

April 6. John L. Childs, Floral Park, N. Y., six Childs' Tree.

May 6. R. M. Kellogg, Ionia, Mich., four Western Triumph.

BOOKS.

March 20. W. A. Burpee & Co., Philadelphia, Pa., "Injurious Insects, and the Use of Insecticides," by F. W. Sempers.

May 23. The Edwards and Docker Publishing Co., Philadelphia, Pa., one copy of American Naturalist.

CHERRY.

April 6. J. W. Adams Co., Springfield, Mass., one Bay State.

July 20. S. B. Heiges, pomologist, Department Agriculture, Washington, D. C., buds of Rupp and Hoke.

CURRENT.

April 2. Wm. Fell & Co., Hexham, England, twelve Victoria Black.

November 1. Albertson & Hobbs, Bridgeport, Ind., six No. 1.

DEWBERRY.

April 16. J. W. Latimer & Co., Pleasanton, Kansas, six plants of an unnamed seedling.

April 20. C. W. Graham, Afton, N. Y., six Sanford.

FLOWERS.

March 8. W. A. Burpee & Co., Philadelphia, Pa., New Golden Mignonette, Fordhook Fancy Balsam, Fairy Blush Poppy, New Pansy No. 272<sup>1</sup>, Dianthus No. 3643, Defiance Pansy.

March 28. C. H. Allen, Floral Park, N. Y., one-half dozen each of Stuart and Winter Cheer Carnations, and 100 Gladioli.

April 3. H. Beyer, New London, Iowa, one packet each of Ornamental Pomegranate and Grandiflora Superba Gaillardia.

April 16. Donor unknown, Stuart and Day Break Carnations.

April 21. Ellwanger and Barry, Rochester, N. Y., five each of the following roses: Persian Yellow, Magna Charta, Anne De Diesbach, Earl of Dufferin, General Jacqueminot, Jean Liabaud, Paul Neyron, Prince Camille, François Levat, Gracilis.

## FIELD CROPS.

March 1. Northrup, Braslan & Goodwin Co., Minneapolis, Minn., one packet each of Early Mastodon, Huron, Pure Yellow Dent and Minnesota King corn; one packet each of Golden Wonder and Hog millet; one packet each of Lincoln and Negro Wonder oats.

March 1. O. H. Alexander, Charlotte, Vt., one packet New Early Sunrise corn.

March 9. Department of Agriculture, Washington, D. C., five packets of Dwarf Essex rape and one packet each of the following: Japan clover, Unknown cow pea, Sweet clover, Spurry, Jerusalem corn, Kaffir corn, Awnless Brome grass, Serradella, Crimson clover, Alfalfa, Spanish peanut.

March 13. Frost & Co., Rochester, N. Y., two cuttings of *Polygonum Sachalinense*.

## GOOSEBERRY.

April 2. Wm. Fell, Hexham, England, 20 Keepsake.

April 9. F. W. Poscharsky, Princeton, Ill., one seedling No. 7.

April 16. Phil. Struble, Naperville, Ill., three No. 2 and two No. 4.

April 16. C. Mills, Fairmount, N. Y., Auburn.

April 27. Dr. I. A. Beach, Cortland, N. Y., wild gooseberry.

May 6. E. A. Orton, North East, Pa., five Orton.

## GRAPE.

March 19. F. W. Guest, Fredonia, N. Y., two plants Guest's No. 1.

March 24. L. T. Saunders, Plain Dealing, La., two Goldstines Early.

April 7. D. S. Marvin, Watertown, N. Y., two Shelby.

April 24. Joel Horner, Delair, N. J., Horner No. 1.

April 27. Prof. J. Craig, Ottawa, Canada, two Kensington.

April 27. Urbana Wine Co., Hammondsport, N. Y., 12 cuttings of Crance.

May 6. R. M. Kellogg, Ionia, Mich., three Hosfords' Mammoth.

May 9. Jas. T. Thompson, Oneida, N. Y., Thompson No. 5 and Thompson No. 7.

May 8. Ellwanger & Barry, Rochester, N. Y., 12 plants each of Delaware, Concord, and Catawba.

MISCELLANEOUS.

March 20. J. H. Tibbitts, Astoria, L. I., one pound of Fungicide.

May 15. J. A. Everitt, Indianapolis, Ind., one-man-weight garden cultivator, with attachments.

August 23. The Deming Co., Salem, Ohio, two Vermorel nozzles and two Bordeaux nozzles on brass rods.

September 1. W. H. Bowker, Boston, Mass., a large number of samples for fertilizer experiments.

September 1. German Kali Works, 93 Nassau street, New York, 13 charts illustrating fertilizer experiments, 25 samples of German potash salts, 26 glass jars.

September 1. New York State Commission, Columbian Exposition, 136 models of apples, 23 models of pears.

NECTARINE.

August 29. E. Smith & Sons, Geneva, N. Y., one Bent.

PEACH.

March 17. Dayton Star Nurseries, Dayton, Ohio, two Champion.

March 23. A. J. Knisley, Benton Harbor, Mich., six each of Kalamazoo, Lewis, Elberta and Gold Drop.

March 23. W. S. Little & Co., Rochester, N. Y., two trees each of Hyatt and Chapman.

March 23. Downing & Morris, Clinton, Ind., Knowles Hybrid and Morris No. 1.

April 2. D. W. Babcock, Dansville, N. Y., two Babcock.

April 6. E. A. Riehl, Alton, Ill., two trees each of Washington and Floss.

April 11. G. H. and J. H. Hale, South Glastonbury, Conn., four trees Crosby.

April 12. Dr. J. I. Bailey, West Branch, Iowa, four trees Bailey.

April 21. Hoopes Bro. & Thomas, West Chester, Pa., two trees American Apricot.

April 30. Farmer Nursery Co., Tadmor, Ohio, three C. Cling.

May 2. O. Engle, Paw Paw, Mich., Murat, Josephine, No. 1 and Mammoth.

August 25. Dr. Thomas Taylor, Washington, D. C., through the United States Department of Agriculture, cions of "Robena."

August 28. Julius Harris, Ridgeway, N. Y., 12 buds Surprise.

August 28. E. Smith & Sons, Geneva, N. Y., buds of Lamont, Early Beauty, Madison County Mammoth and Welcome.

September 5. J. S. Ford, Pittsford, N. Y., Ford's Choice.

September 10. L. T. Sanders, Plain Dealing, La., Sentell Cling, Garden Cling and Indian Chief.

November 1. Albertson & Hobbs, Bridgeport, Ind., two Patterson.

#### PEAR.

March 20. Augustine & Co., Normal, Ill., one Lincoln.

April 16. S. C. Moore, Morrisville, Pa., cions of Miriam.

April 17. H. S. Anderson, Union Springs, N. Y., cions of Dr. Farley.

December 3. Department of Agriculture, Washington, D. C., cions of Summer Beauty.

#### PLUM.

March 22. Hammond & Willard, Geneva, N. Y., 35 Lombard, four Abundance, two Prince Englebert, two Italian Prune, four Satsuma and eight Burbank trees.

March 20. Augustine & Co., Normal, Ill., one Simpson.

April 6. C. L. Watrous, Des Moines, Iowa, cions of Wyant, Ocheeda, Rockford, Hawkeye and Milton.

April 18. W. & T. Smith, Geneva, N. Y., one tree each of the following: Arch Duke, Bavay's Green Gage, Batan, Bradshaw, Burbank, Coe's Golden Drop, De Soto, Duane's Purple, Field, Forest Garden, Frogmore Damson, Gen. Hand, German Prune, Grand Duke, Gueii, Hudson River Purple Egg, Imperial Gage, Italian Prune, Jefferson. King of Damsons, Lombard, McLaughlin, Monroe. Monarch, Mogul, Niagara, Ogon, Pond's Seedling, Prunus Simonii, Quackenbos, Shipper's Pride, Shropshire Damson, Smith's Orleans, Smith's Prune, Union Purple, Washington, Yellow Egg.

April 25. Ellwanger & Barry, Rochester, N. Y., two each of Shropshire Damson, Reine Claude Violette and Youngken's Golden.

July 24. C. L. Watrous, Des Moines, Iowa, buds of following: Hawkeye, Wyant, Milton, Hammer, Rockford, Charles Downing, Ocheeda, New Ulm, Cheney, Golden Beauty.

October. W. & T. Smith, Geneva, N. Y., one each of the following: King of Damsons, Frogmore Damson, Gueii, Washington, Jefferson, Monroe, Imperial Gage, German Prune, Monarch, Italian Prune.

POTATO.

April 2. S. J. Smith, ——— ———, two seedlings.

April 23. J. A. Everitt, Indianapolis, Ind., Six Weeks, Green Mountain, Rural New Yorker, Early Everitt, Everitt's Heavy Weight, Everitt's Colossal.

April 30. Richard Nott, Burlington, Vt., seedling No. 7.

May 17. C. M. Goodspeed, Shamrock, N. Y., tuber of a seedling.

May 23. F. B. Mills, Rose Hill, N. Y., Mills seedling No. 60.

QUINCE.

April 6. J. W. Adams Co., Springfield, Mass., one Borgeat.

RASPBERRY.

March 17. O. A. Kenyon, McGregor, Iowa, ten Kenyon's seedling red.

March 23. Charles Schlessler, Naperville, Ill., six seedlings IXL red.

March 22. Joseph T. Thompson, Oneida, N. Y., six tips Columbian.

March 24. Cleveland Nursery Co., Rio Vista, Va., six King.

March 28. Prof. M. H. Beckwith, Experiment Station, Newark, Del., unnamed seedling red.

April 2. D. W. Babcock, Dansville, N. Y., five Babcock No. 9, six Babcock No. 3, two Babcock No. 5A, five Babcock No. 5.

April 5. B. D. Garvin & Son, Wheeling, W. Va., six plants Pioneer.

April 9. F. W. Poscharsky, Princeton, Ill., six each No. 9, No. 15 and No. 3.

April 12. M. I. Ellis, Norwood, Mass., seven plants Talbot Prolific.

April 16. F. W. London, Janesville, Wis., six London.

April 15. W. D. Barns & Son, Middle Hope, N. Y., one plant each of Golden Prague, English Giant and Red Sweet.

April 21. J. P. Morrison, Forestville, N. Y., three Morrison's seedlings.

April 23. J. Wragg & Sons, Waukee, Iowa, three Redfield tips.

May 1. C. Mills, Fairmount, N. Y., Mills No. 7, Mills No. 15 and six plants Palmer.

May 2. Ellwanger & Barry, Rochester, N. Y., six plants Superlative.

May 4. A. M. Purdy, Palmyra, N. Y., six plants each of Hopkins and Eureka.

#### STRAWBERRY.

March 24. Cleveland Nursery Co., Rio Vista, Va., six each of Richmond Early, America, Charlie, Equinox, Edith.

April 2. Eichholtz's unnamed seedling, from U. S. Division of Pomology, Washington, D. C.

April 5. T. J. Dwyer, Cornwall, N. Y., 24 new strawberries.

April 6. McMath Bros., Onley, Va., 25 plants Regina.

April 7. B. M. Watson, Plymouth, Mass., 25 Mexican Everbearing, and 25 White Novelty.

April 10. Green's Nursery Co., Rochester, N. Y., 10 Jay Gould.

April 20. W. Y. Velie, Marlboro, N. Y., three Giant.

April 21. G. Cowing, Muncie, Ind., 12 Blonde and 24 Brunette.

April 25. R. D. McGeehon, Atlantic, Iowa, Young's Seedling.

April 30. R. F. Smith, Lawrence, Kansas, 12 Dew Drop.

May 1. R. Johnston, Shortsville, N. Y., Champion of England.

May 2. W. I. Hood & Co., Richmond, Va., Tennessee Prolific.

May 3. M. Crawford, Cuyahoga Falls, Ohio, Annie Laurie.

May 4. E. J. Hull, Olyphant, Pa., 25 plants each of Orange County, Ona and Iowa Beauty.

May 7. B. O. Curtis, Paris, Ill., 12 each of Enormous and Paris King.

May 12. B. F. Lincoln, West Hingham, Mass., 13 Bostonian.

May 18. C. S. Pratt, Reading, Mass., 25 Marston.

May 21 and June 19. A. H. Griesa, Lawrence, Kansas, 12 Mele.

August 15. J. H. Hadsell, Bath, N. Y., unnamed seedling.

September 21. H. A. Wilder, Akron, N. Y., 25 plants each of Wilder No. 5 and Wilder No. 7.

#### VEGETABLES.

March 7. James M. Thorborn, New York N. Y., two ounces Columbian Mammoth White asparagus seed.

March 1. Northrup, Braslan & Goodwin Co., Minneapolis, Minn., one packet each of the following: Kentucky Wonder

watermelon, Kalamazoo celery, Golden Ball lettuce, Harvest Home cabbage, Model cauliflower, Portland and Zig Zag Evergreen sweet corn, Sapphira peas.

March 1. James Vick's Sons, Rochester, N. Y., one packet each Prolific Pickler bean, Charmer and King of the Dwarfs peas.

March 1. O. H. Alexander, Charlotte, Vt., one packet Dwarf Telephone peas and one each of the following beans: Horticultural Pole Lima No. 2, Winner Bush, Broad Buff, Horticultural Lima No. 3, New White.

March 1. C. S. Bond, Worthington, Minn., one packet Bond's Early Minnesota tomato.

March 8. W. A. Burpee, Philadelphia, Pa., one packet each of the following: New Danish Improved sugar beet, Early Black Lima Pole bean, Burpee's Bush Lima bean, New Stringless Green Pod Bush bean, Renown pea, The Echo pea, Early Fordhook sweet corn, Fordhook Early watermelon, White Wonder cucumber, Victoria spinach, Best Early cauliflower, Golden Dusden radish, All-Head Early cabbage, Sure-Head cabbage, Fordhook squash, Melrose muskmelon, Fordhook First tomato, Matchless tomato, New Improved French Breakfast radish, Wheeler's Tom Thumb lettuce, New Pink Prizetaker onion, White Victoria onion, Columbia beet, New Giant White Co.'s lettuce, Iceberg lettuce, Eckford's Gilt-edge pea, American Belle sweet pea.

March 9. Department of Agriculture, Washington, D. C., four packets each of the following: Snowball cauliflower, The Gloss radish, Stump-rooted parsnip, Improved New York egg plant, Denver Market lettuce, Kansas melon, Golden Ball turnip, Ponderossa tomato, Bermuda onion, Winter spinach, Prizetaker onion, Snowball turnip, Kentucky Wonder watermelon, Grand Rapids lettuce, Dingo Blood Turnip beet; two packets each of Burpee's Bush Lima bean, Sterling pea, Sugar pea, Kentucky Wonder pea, Zig-Zag sweet corn.

March 12. James Wood, Mt. Kisco, N. Y., one packet each of watermelon and muskmelon seeds.

March 23. N. B. Keeney & Son, Le Roy, N. Y., one packet Ne Plus Ultra bean.

March 20. R. Morrill, Benton Harbor, Mich., one packet Osage muskmelon.

April 3. H. Beyer, New London, Iowa, two packets Pride of America sweet corn, three packets New Sandwich radish and one packet each of the following: Henderson's Dwarf Caseknife bean, Beyer's New Dun-colored Dwarf Caseknife bean, Mammoth Tasmanian Pole bean, Early Long Purple radish, Elephant's Trunk pepper, Coral Gem Boquet pepper, Mammoth Golden Queen pepper, New Ice Cream muskmelon.

April 23. W. B. Garlock, Newark, N. Y., one packet Rockford Market Early sweet corn.

April 28. J. A. Everitt, Indianapolis, Ind., Wisconsin True bean.

May 24. J. A. Everitt, Indianapolis, Ind., one packet of a Dwarf bean.

#### **Newspapers and Periodicals Presented to the Station.**

Agricultural Epitomist, Indianapolis, Ind.

Albany Weekly Journal, Albany, N. Y.

Allegan Gazette, Allegan, Mich.

American Agriculturist, New York, N. Y.

American Cultivator, Boston, Mass.

American Dairyman, New York, N. Y.

American Grange Bulletin, Cincinnati, Ohio.

American Grocer, New York, N. Y.

American Stock Keeper, Boston, Mass.

American Veterinary Review, New York, N. Y.

Baltimore Weekly Sun, Baltimore, Md.

Canadian Entomologist, Fort Hope, Canada.

Canadian Horticulturist, Grimsby, Ontario, Canada.

Clover Leaf, South Bend, Ind.

Country Gentleman, Albany, N. Y.

Dairy World, London, England.

Detroit Free Press, Detroit, Mich.

Every Week, Angelica, N. Y.

Farmers' Advocate, London, Canada.

Farmers' Magazine, Springfield, Ill.

Farm and Dairy, Ames, Iowa.

Farm and Fireside, Philadelphia, Pa.

Farm and Home, Springfield, Mass.

Farmers' Home, Dayton, Ohio.

Farm Journal, Philadelphia, Pa.

Farm Life, Rochester, N. Y.

- Farm, Stock and Home, Minneapolis, Minn.  
 German Agricultural and Horticultural Journal, Milwaukee, Wis.  
 Grange Visitor, Lansing, Mich.  
 Hoard's Dairyman, Fort Atkinson, Wis.  
 Industrial American, Lexington, Ky.  
 Iowa Weather Crop Service Review, Des Moines, Iowa.  
 Jersey Bulletin, Indianapolis, Ind.  
 Journal of Comparative Medicine and Veterinary Archives, Philadelphia, Pa.  
 Ladies' Home Companion, Philadelphia, Pa.  
 Louisiana Planter and Sugar Manufacturer, New Orleans, La.  
 Maryland Farmer, Baltimore, Md.  
 Mirror and Farmer, Manchester, N. H.  
 Monthly Weather Review, Washington, D. C.  
 National Dairyman, Kansas City, Mo.  
 National Nurseryman, Rochester, N. Y.  
 Nebraska Bee-Keeper, York, Neb.  
 Nebraska Farmer, Lincoln, Neb.  
 New England Farmer, Boston, Mass.  
 Northwestern Farmer, St. Paul, Minn.  
 Northwestern Pacific Farmer, Portland, Oregon.  
 Orange County Farmer, Port Jervis, N. Y.  
 Orange Judd Farmer, Chicago, Ill.  
 Peninsula Farmer, Federalsburg, Md.  
 Planters' Monthly, Honolulu, H. I.  
 Poultry Monthly, Albany, N. Y.  
 Practical Farmer, Philadelphia, Pa.  
 Prairie Farmer, Chicago, Ill.  
 Progressive South, Richmond, Va.  
 Southern Cultivator, Atlanta, Ga.  
 Southern Planter, Richmond, Va.  
 Stock and Farm, Bunker Hill, Ind.  
 Sugar Beet, Philadelphia, Pa.  
 Sugar Bowl and Farm Journal, New Orleans, La.  
 Sugar Planters' Journal, New Orleans, La.  
 Utah Church and Farm, Salt Lake City, Utah.  
 Vermont Farmers' Advocate, Burlington, Vt.  
 Village Record, West Chester, Pa.  
 Western Plowman, Moline, Ill.

## REPORT OF THE FIRST ASSISTANT.

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During the year 1894, the work in charge of the first assistant has been similar to that of the two preceding years. Much time has been spent in attending to part of the very large amount of necessary routine work connected with the general Station management, including considerable correspondence. The feeding of the dairy cattle under experiment has been superintended and the pig feeding attended to. Feeding experiments with hens have been continued and a number of chicks have been grown in connection with the breeding experiments mentioned in the annual report for 1893. Data concerning the yield, etc., from the set of field plats treated with crude chemicals, were collected as usual.

### Cattle Feeding.

In feeding milch cows, the coarse foods used during the year have been: Clover hay, mixed hay (clover and timothy), timothy hay, corn stover, corn silage, alfalfa forage, oat-and-pea forage, corn forage, and beets. The grain foods used during the year have been: Wheat bran, corn meal, wheat middlings, ground oats, gluten feed, linseed meal, O. P., cottonseed meal, and "King" gluten meal. A few other coarse foods, such as alfalfa hay and rape forage, were fed to bulls although not to cows.

During January the milch cows were fed, from the 1st to 15th, clover hay, morning and noon and corn silage at night. For the rest of the month corn stover was fed in the morning, corn silage at noon and clover hay at night. The mixed grain fed morning and night throughout the month consisted of five parts wheat bran, five parts gluten feed, two parts wheat middlings, two parts linseed meal, O. P., one part corn meal, and one part ground oats.

From the 1st to the 15th of February, corn stover was fed in the morning, corn silage at noon and clover hay at night. For the rest of the month clover hay was fed morning and night and corn silage at noon. A mixed grain consisting of six parts wheat bran, five parts gluten feed, two parts cottonseed meal, and one part linseed meal, O. P., was fed twice daily throughout the month.

During March corn silage was fed morning and noon and clover hay at night. The mixed grain was the same as was fed during the preceding month.

From April 1 to 15 corn silage was fed morning and noon and clover hay at night. For the rest of the month clover hay was fed morning and night and silage at noon. The mixed grain fed twice daily throughout the month was composed of five parts wheat bran, two parts corn meal, one part cottonseed meal, one part gluten feed and one part wheat middlings.

For the first 10 days in May the ration was the same as for the latter part of April. From the 10th to the 15th corn silage was fed in the morning, alfalfa forage at noon and clover hay at night. For the rest of the month alfalfa forage was fed morning and noon and hay at night. The mixed grain fed twice daily throughout the month was the same as that fed during April.

During June alfalfa forage was fed morning and noon and hay at night. The mixed grain fed consisted of five parts wheat bran, five parts corn meal, one part wheat middlings and one part ground oats.

During July oat-and-pea forage was fed morning and noon and clover hay at night. The mixed grain fed during June was also fed this month.

From the 1st to the 10th of August alfalfa forage was fed three times a day and a mixed grain twice daily composed of eight parts corn meal, four parts wheat bran, one part wheat middlings, one part "King" gluten meal and one part ground oats. From August 10 to 31 corn silage was fed three times a day and twice daily a mixed grain, composed of six parts wheat bran, two parts "King" gluten meal, one part ground oats and one part cottonseed meal.

From September 1 to 15 alfalfa forage was fed in the morning, oat and-pea forage at noon and night. The grain mixture fed at

this time was the same as that fed the first part of August. For the latter half of September corn forage was fed three times a day, and twice daily a grain mixture, consisting of five parts wheat bran, one part "King" gluten meal, one part linseed meal, O. P., and one part cottonseed meal.

For the first 15 days of October timothy hay was fed three times a day and the same grain mixture that was used during the latter part of the preceding month. From the 15th to the 31st alfalfa forage was fed morning and noon and timothy hay at night. The grain mixture consisted of six parts corn meal, five parts wheat bran, one part wheat middlings, one part gluten feed, one part linseed meal, O. P., and one part cottonseed meal.

During November beets were fed morning and noon and mixed hay (clover and timothy) at night. The grain mixture consisted of five parts wheat bran, two parts corn meal, two parts gluten meal, "King," one part wheat middlings, one part linseed meal, O. P., one part cottonseed meal and one part ground oats.

During the month of December corn silage has been fed morning and noon and mixed hay at night. The grain mixture fed twice daily has been the same as that for November.

Hay, silage and forage were fed at 5 o'clock A. M., at about 11.30 A. M. and at 5 P. M. Grain was fed separately, and just before the hay or forage was weighed out to the cows, at 5 o'clock A. M. and at 5 P. M. Milking was begun in the morning and at night at the same time that the grain was fed. Cows in approximately the same stage of lactation were fed as nearly alike as possible, but the proportions of the different foods were varied somewhat according to the condition, appetite and age of the individual. During the larger part of the milking period each cow was fed the rations just mentioned, but for about six weeks just before calving little or no grain was fed; and generally for three or four weeks before calving only hay (not much clover) and beets were fed. For the first few days after calving, as a rule, the only grain food was wheat bran or a mixture of bran and ground oats.

A bulletin has been prepared giving most of the data, in the form of average results per cow, obtained in a number of feeding

trials in which alfalfa forage has been used. This matter in the bulletin is as follows:

### Alfalfa Forage for Milch Cows.

The importance of feeding leguminous crops has led to many inquiries concerning the value of alfalfa as forage for milch cows, for the alfalfa is much liked by cattle and other animals and contains an unusually large proportion of nitrogenous constituents. The rapid growth of the plant, which can be cut three times during the season, and often four times, makes it especially worthy of consideration where soiling methods are practiced.

A few of our farmers have grown good crops of alfalfa successfully for several years, but it does not seem suited to some sections of the State. Alfalfa has grown well on the Station farm, although the soil is a rather heavy clay. A field of alfalfa of 2.28 acres, sown in 1890, yielded this season (1894) for the first two cuttings—the first during June and the second about August 1st—at the rate of 24,500 pounds of green forage per acre. On account of very severe drought, the third cutting was very light, and only part of the field was cut for the fourth time. Another field of alfalfa of 1.3 acres, sown in 1893, yielded at the rate of 33,800 pounds of green forage per acre, as the total for four cuttings. The last two cuttings were very light on account of severe drought. The first two cuttings, from May 11 to 31 and from July 9 to 28, yielded at the rate of a little over 12 tons of green forage per acre. These fields had been steadily cropped and not well manured for some years before sowing to alfalfa and were not in condition to produce heavy crops.

As testimony in regard to the feeding value of alfalfa forage it is thought desirable to give the results of some feeding trials made during the past few years at this station, in which alfalfa forage, oat-and-pea forage and some other foods have been fed. The results which are reported in this bulletin were obtained from animals in the stage of lactation where a fair flow of milk of normal composition would be expected, and any general change in the quantity or quality of the product, besides the gradual change as the period of lactation advanced, might be reasonably attributed to the influence of the different foods. Individual records for each cow were kept, separate analyses of the milk

having been made. Only the average results are here given. As varying amounts of milk of different quality were given by different animals the actual weights of the different constituents yielded by each cow were considered in determining the average composition of all the milk.

A sufficient supply of one kind of forage was not always obtainable for periods longer than 15 days—as a number of other animals besides those from which the results are here reported were always fed at the same time;—but whenever a good succession was available one kind of forage was fed for a month. The periods of feeding are, therefore, often not so long as would be desired. For the purpose of securing data, other than that here reported, relative to the production of individual animals, it was necessary to feed a fairly constant proportion of grain at certain months of lactation. On this account no results are here reported that have been obtained when the forage was fed without grain. The grain was fed in moderate quantities, but always separately from the coarse fodder, so that if any should be left at any time it could be weighed. The grain was fed twice daily, at 5 o'clock A. M. and at 5 o'clock P. M., in generally equal quantities—when there was any difference the evening feed was one-half pound the greater. Forage or hay was fed at 5 o'clock A. M., at 11:30 A. M. and at 5 o'clock P. M. The forage and hay were generally fed in quantities likely to be entirely eaten, but account was kept of any food left to the amount of one ounce. Only the weight of food actually consumed is given in the tables. The cows were milked at 5 o'clock A. M. and at 5 o'clock P. M. Analyses were made at frequent intervals of milk from each cow, and all the foods were analyzed.

In estimating the amounts of digestible constituents in the different foods the average co-efficients of digestibility obtained in digestion experiments made in this country and Germany were used. Whenever enough data were available the American co-efficients were used.

In calculating the cost of the rations, wheat bran was rated at \$18 per ton, corn meal at \$20, ground oats at \$25, linseed meal, O. P., at \$27, linseed meal, N. P., at \$25, gluten meal at \$25, wheat middlings at \$20, cottonseed meal at \$30, gluten feed at

\$18, and ground flaxseed at \$60, per ton. All hay was rated at \$10 per ton, corn silage at \$3, roots at \$3, and all green forage at \$2 per ton. It is thought better to assume the one valuation for any food throughout all the trials, which extended over portions of four seasons, than to attempt to follow fluctuations of market price. Enough data are given to allow of recalculation, by any who desire, of the cost of rations at other prices for foods than those just stated. All forage has been placed at the same valuation per ton. The cost of production per ton of corn forage will hardly be the same as for oat-and-pea forage, etc. There is more labor necessary to establish a good stand of alfalfa than for the sowing of the oats and peas or similar crops, but after alfalfa is once established it will furnish three or more cuttings each season with little more labor expense than that of harvesting the crop. Not enough data are available, at present, however, to warrant us in fixing certain different cost valuations per ton.

Table I gives the results obtained in feeding 14 cows from May 15 to July 15, 1891. The average age of these cows was on June 1, three years, and they had been in milk on the average 6.8 months at the beginning of this feeding trial.

From May 16 to May 31 inclusive, corn silage was fed in the morning and at noon, mixed hay, clover and timothy, at night and a mixed grain (No. 16) consisting of six parts wheat bran, three parts corn meal, and two parts linseed meal, O. P. The grain represented 48.6 per cent. of the cost of the ration and supplied 39.7 per cent. of the total digestible nutrients. The silage represented 30.0 per cent. of the cost of the ration and supplied 35.8 per cent. of the digestible nutrients.

From June 1 to June 15, inclusive, corn silage was fed in the morning, alfalfa forage at noon and mixed hay at night. The grain fed (No. 17) consisted of four parts wheat bran, four parts ground oats, five parts corn meal, and two parts gluten meal. The grain represented 52.4 per cent. of the cost of the ration and supplied 38.3 per cent. of the digestible nutrients. The silage and forage represented 24.6 per cent. of the cost of the ration and supplied 27.7 per cent. of the digestible nutrients.

From June 16 to June 30, inclusive, alfalfa forage was fed morning and noon, and hay at night. The same grain was fed as in the preceding period. The grain represented 54.5 per cent. of

TABLE I — A.

PERIOD.	Average live weight per cow during period. Lbs.	AVERAGE PER DAY PER COW.					
		Water. Lbs.	Corn silage. Lbs.	Alfalfa forage. Lbs.	Mixed hay. Lbs.	Grain No. 18. Lbs.	Total food. Lbs.
May 16 to 31. ....	823.6	52.43	26.75	.....	6.20	6.66	39.61
June 1 to 15. ....	833.2	60.92	13.63	14.91	6.32	*6.72	40.58
June 16 to 30. ....	843.7	61.63	.....	28.86	6.33	*6.75	41.94
July 1 to 15. ....	846.5	53.22	30.84	.....	6.35	*6.75	43.94
							16.99
							18.65
							19.77
							18.45

\* No. 17.      † Oat-and-pea forage.

## B.

PERIOD.	AVERAGE PER DAY PER COW.							
	Moisture in food. Lbs.	Ash in food. Lbs.	Protein in food. Lbs.	Fats in food. Lbs.	Crude fibre in food. Lbs.	N. free extract in food. Lbs.	Total organic matter in ration. Lbs.	Ratio of total protein to total carbohydrates in food. (Fats $\times \frac{1}{4}$ .)
May 16 to 31. ....	22.62	.91	2.59	1.00	3.81	8.69	16.08	1:5.7
June 1 to 15. ....	21.93	1.07	2.97	1.16	4.15	9.33	17.58	1:5.4
June 16 to 30. ....	22.17	1.27	3.52	1.21	4.47	9.30	18.50	1:4.7
July 1 to 15. ....	25.49	1.09	3.04	1.01	4.29	9.01	17.36	1:5.1
							10.35	
							11.49	
							12.14	
							11.38	

C.

PERIOD.	Nutritive ratio (Fats 22%.)	PER 1,000 POUNDS LIVE WEIGHT FED.						
		Digestible protein. Lbs.	Digestible fibre. Lbs.	Digestible N. free extract. Lbs.	Digestible fat. Lbs.	Total digest- ible nutrients. Lbs.	Total organic matter in ration. Lbs.	Calories of energy in ration. Cal.
May 16 to 31.....	1:6.3	1.87	2.51	7.29	.90	12.57	19.53	25504
June 1 to 15 .....	1:5.8	2.22	2.58	8.02	.97	13.79	21.10	27939
June 16 to 30 .....	1:4.7	2.71	2.63	8.08	.96	14.38	21.93	29012
July 1 to 15.....	1:5.5	2.23	3.26	7.12	.83	13.44	20.51	26957

D.

PERIOD.	Per cent. of ash in milk.	Per cent. of fat in milk.	Per cent. of casein and albu- men in milk.	Per cent. of sugar in milk	AVERAGE PER DAY PER COW.				
					Ash in milk. Lbs.	Fat in milk. Lbs.	Casein and albumen in milk. Lbs.	Sugar in milk. Lbs.	Total solids in milk. Lbs.
May 16 to 31.....	.66	4.03	3.73	5.23	.11	.67	.62	.87	2.27
June 1 to 15.....	.75	4.10	3.76	5.20	.13	.71	.65	.90	2.39
June 16 to 30.....	.70	3.66	3.43	4.31	.12	.63	.59	.74	2.08
July 1 to 15.....	.72	4.10	3.68	5.01	.12	.68	.61	.83	2.24

## E.

PERIOD.	Total cost of food; average per day per cow. Cents.	Milk yield; average per day per cow. Lbs.	Pounds of water-free food consumed for one pound of milk produced. Lbs.	Pounds of water-free food consumed for one pound of milk solids produced. Lbs.	Pounds of water-free food consumed for one pound of fat produced. Lbs.	Cost of food for one pound of milk. Cents.	Cost of food for one pound of milk solids. Cents.	Cost of food for one pound of fat in milk. Cents.
May 16 to 31.....	13.83	16.64	1.02	7.49	25.36	.83	6.09	20.64
June 1 to 15.....	13.75	17.31	1.08	7.80	26.27	.79	5.75	19.37
June 16 to 30.....	13.29	17.19	1.15	9.50	31.38	.77	6.39	21.10
July 1 to 15.....	13.49	16.57	1.11	8.24	27.13	.81	6.02	19.84

the cost of the ration and supplied 36.2 per cent. of the digestible nutrients. The forage represents 21.7 per cent. of the cost of the ration and supplied 40.9 per cent. of the digestible nutrients.

From July 1 to 15, inclusive, oat-and pea forage was fed morning and noon, and clover hay at night. The same grain was fed as during the preceding period. The grain represented 53.6 per cent. of the cost of the ration, and supplied 38.7 per cent. of the digestible nutrients. The forage represented 22.8 per cent. of the cost of the ration, and supplied 37.4 per cent. of the digestible nutrients.

For the 15 days preceding May 16 the ration had been the same as it was from May 16 to May 31. The cows gained in weight from 8 to 11 pounds on the average during each of the first three periods. During the fourth period the loss in weight per cow is rated at from four to five pounds, although this loss is only estimated from the total loss during July, the cows not having been weighed until the 28th, after corn silage and alfalfa forage had been again fed.

The greatest amount of organic matter was in the ration for the third period, when the largest amount of alfalfa was fed, and the cost of the ration was somewhat the lowest. The ration contained the largest amount of digestible protein and the nutritive ratio was the narrowest, that of 1:4.7. The cost of food for weight of milk produced was lowest during the third period and the cost of fat the highest. The greatest amount of digestible fat was contained in the ration for the second period and the most fat was produced in the milk. The cost of fat produced was lowest during the second period. During the third period the forage supplied a larger proportion of the digestible nutrients than during any other period — that of 40.9 per cent. — although the cost of the forage was but 21.7 per cent. of the cost of the ration. The grain at this time supplied but 36.2 per cent. of the digestible nutrients and represented 54.5 per cent. of the cost of the ration.

For the first period the greatest daily average milk yield was 22.1 pounds and the smallest 11.5 pounds; the highest average per cent. of fat was 5.45 and the lowest 2.88 per cent. For the

second period the greatest daily average milk yield was 22.6 pounds and the smallest 11.0; the highest average per cent. of fat was 5.71 and the lowest 2.76. For the third period the extremes in daily average milk yield were 23.9 pounds and 10.0 pounds; the extremes in average per cent. of fat were 6.17 and 2.80. For the fourth period the extremes were 23.8 pounds and 9.9 pounds of milk and 6.10 per cent. and 2.88 per cent. of fat.

The composition of each food used from May 15 to July 15 is shown in the following tabulated form :

	Moisture. Per cent.	Ash. Per cent.	Protein Per cent.	Crude fibre. Per cent.	Nitrogen free extract. Per cent.	Fats. Per cent	IN WATER-FREE SUBSTANCE	
							Total nitrogen. Per cent.	Albu- minoid nitro- gen Per cent.
Corn silage.....	77.6	1.0	3.0	5.4	11.5	1.5	2.11	.....
Alfalfa forage.....	71.9	2.4	6.6	7.3	10.1	1.7	.....	.....
Oat-and-pea forage.....	77.8	1.8	3.5	6.8	8.9	1.2	2.54	1.66
Mixed grain No. 16.....	13.5	4.4	16.5	7.9	52.8	4.9	3.06	2.85
Mixed grain No. 17.....	11.5	3.1	14.4	4.7	60.8	5.5	2.60	.....
Mixed hay (May 16 to May 31).....	15.5	5.6	11.2	29.7	33.7	4.3	2.12	1.80
Mixed hay (June 1 to June 30).....	10.1	5.9	10.2	32.2	36.1	5.5	.....	.....
Clover hay (July 1 to July 15).....	11.4	5.1	15.6	29.5	34.1	4.3	2.82	1.52

Table II gives the results obtained in feeding eight cows from August 1 to September 15, 1891. On August 1 the average age of these cows was 2.9 years, and they had been in milk at that date on the average 5.3 months. From August 1 to August 15, inclusive, alfalfa forage was fed in the morning, corn silage at noon and night, and a mixed grain (No. 19) consisting of five parts wheat bran, five parts corn meal, two parts wheat middlings and three parts linseed meal, N. P. The grain cost 53.4 per cent. of the cost of the ration and supplied 37.7 per cent. of the digestible nutrients. The silage and forage represented the smaller part of the total cost of the ration and supplied the larger part of the digestible nutrients.

From August 15 to August 31, inclusive, corn silage was fed morning and night, timothy forage at noon, and the same mixed grain (No. 19) that was fed during the preceding period. The grain cost 53.8 per cent. of the total cost of ration and supplied 36.1 per cent. of the total digestible nutrients, the silage and forage representing 46.2 per cent. of the cost and supplying 63.9 per cent. of the digestible nutrients.

From September 1 to September 15, inclusive, barley-and-pea forage was fed morning and night, hay at noon, and the same grain (No. 19). The grain cost 51.2 per cent. of the total cost of the ration and supplied 33.2 per cent. of the digestible nutrients. The forage represented 24.7 per cent. of the cost of the ration and supplied 45.6 per cent of the digestible nutrients.

During each of the first two periods the cows gained in weight on the average about 27 pounds and during the last period the gain in weight was less, being about four pounds on the average per cow for the whole of September. In the change from the first period to the second, when timothy forage was substituted for alfalfa forage, there was considerably more than the normal decrease of milk yield although the total food consumed was about the same; the total organic matter, the total digestible nutrients and the fuel value being about the same—slightly increased. There was the same amount of digestible fat but considerably less digestible protein in the second ration; the nutritive ratio being changed from 1:6.3 to 1:7.7. The cost of the second ration was somewhat less but the cost of production of milk, and its constituents, was somewhat more than for the first period. By a change to

TABLE II — A.

PERIOD.	AVERAGE PER DAY PER COW.							
	Average live weight per cow during period. Lbs.	Water. Lbs.	Corra silage. Lbs.	Alfalfa forage. Lbs.	Timothy forage. Lbs.	Mixed hay. Lbs.	Mixed grain No. 12. Lbs.	Total food. Lbs.
August 1 to 15.....	894.8	51.23	29.89	13.92	.....	.....	6.63	50.43
August 16 to 31.....	851.8	50.13	26.23	.....	18.47	.....	6.63	51.33
September 1 to 15.....	866.2	59.33	.....	.....	*32.47	6.34	6.63	45.44
								17.33
								17.45
								19.88

\* Barley-and-pea forage.

## B.

PERIOD.	AVERAGE PER DAY PER COW.							
	Moisture in food. Lbs.	Ash in food. Lbs.	Protein in food. Lbs.	Fats in food. Lbs.	Crude fibre in food. Lbs.	N. free extract in food. Lbs.	Total organic matter in food. Lbs.	Total digestible nutrients. Lbs.
August 1 to 15.....	33.10	1.54	2.49	.77	3.11	9.93	15.79	11.36
August 16 to 31.....	33.88	1.07	2.21	.84	3.36	9.97	16.38	11.87
September 1 to 15.....	25.56	1.21	3.13	.81	4.21	10.53	18.67	12.93
								1:5.9
								1:6.9
								1:5.3

Ratio of total protein to total carbohydrate in food. (Fam 224).

## C.

PER 1,000 POUNDS LIVE WEIGHT FED.

PERIOD.	Nutritive ratio.	Digestible protein. Lbs.	Digestible fibre. Lbs.	Digestible N free extract. Lbs.	Digestible fat. Lbs.	Total digestible nutrients. Lbs.	Total organic matter in ration. Lbs.	Calories of energy in ration. Cal.
August 1 to 15 .....	1:6.3	2.02	2.24	8.78	.73	13.77	19.14	27385
August 16 to 31 .....	1:7.7	1.70	2.76	8.75	.73	13.94	19.23	27651
September 1 to 15 ....	1:5.3	2.52	3.20	8.55	.86	14.93	21.55	29317

## D.

AVERAGE PER DAY PER COW.

PERIOD.	Per cent. ash in milk.	Per cent. fat in milk.	Per cent. casein and albumen in milk.	Per cent. sugar in milk.	Ash in milk. Lbs.	Fat in milk. Lbs.	Casein and albumen in milk. Lbs.	Sugar in milk. Lbs.	Total solids in milk. Lbs.
August 1 to 15 .....	.72	3.49	3.49	5.21	.13	.63	.63	.94	2.33
August 16 to 31 .....	.69	3.88	3.56	4.94	.11	.62	.57	.79	2.09
September 1 to 15 .....	.76	4.12	3.57	4.74	.11	.60	.52	.69	1.92

## E.

PERIOD.	Total cost of food; aver- age per day per cow. Cents.	Milk yield; average per day per cow. Lbs.	Pounds of water-free food con- sumed for one pound of milk pro- duced. Lbs.	Pounds of water-free food con- sumed for one pound of milk- solids pro- duced. Lbs.	Pounds of water-free food con- sumed for one pound of fat produced. Lbs.	Cost of food for one pound of milk. Cents.	Cost of food for one pound of milk-solids. Cents.	Cost of food for one pound of fat in milk. Cents.
August 1 to 15 .....	12.60	18.05	.96	7.44	27.51	.70	5.41	20.00
August 16 to 31 .....	12.52	15.98	1.09	8.35	28.15	.78	5.99	20.19
September 1 to 15 .....	13.16	14.56	1.37	10.35	33.13	.90	6.85	21.93

barley-and-pea forage and hay in the third ration there was an increase in the total organic matter of the ration, the amount of digestible nutrients, the digestible protein, and of the fuel value, although at a slight increase of cost. The nutritive ratio was made narrower — that of 1:5.3. There was considerable decrease in the milk yield, however, although not so much as followed the first change. The cost of milk, of the milk-solids and fat, was somewhat greater for the third period.

The greatest daily average yield of milk for the first period was 30.3 pounds and the smallest 11.7 pounds. The highest average per cent. of fat was 4.77 and the lowest 2.30. For the second period the extreme daily average milk yields were 26.7 pounds and 9.4 pounds; the extremes in average percentage of fat were 5.62 and 1.92. For the third period the extremes in daily average yield of milk were 24.7 pounds and 8.7 pounds; and in average percentage of fat 5.28 and 2.83. The following table shows the composition of each food used during this trial :

	Moisture. Per cent.	Ash. Per cent.	Protein. Per cent.	Crude fibre. Per cent.	Nitrogen free extract. Per cent.	Fats. Per cent.	In Water-Free Sub- stance.	
							Total nitrogen. Per cent.	Albuminoid nitrogen. Per cent.
Corn silage.....	74.1	1.2	2.2	6.0	15.5	1.0	1.85	1.19
Alfalfa forage.....	78.9	2.7	4.6	6.8	11.6	.9	2.83	2.09
Timothy forage.....	74.6	2.5	2.4	7.3	11.9	1.3	1.54	1.29
Barley-and-pea forage.....	74.1	1.9	4.2	6.8	12.0	1.0	2.61	2.05
Mixed hay.....	13.2	4.6	9.1	24.6	46.2	2.3	1.67	1.55
Mixed grain No. 19.....	9.9	4.6	18.0	6.6	55.8	5.1	3.20	2.82

In table III are compared the results obtained in three periods of feeding from September 1 to October 15, 1891, with eight cows. The same cows were used as during the preceding trial, the results of which were given in table II. The first period, from September 1 to 15, is the same as the last period in the preceding group, but the results are repeated for comparison. The cows had been in milk on the average 7.3 months by October 1, and the average age was a little over three years.

In the second period from September 16 to September 30 alfalfa forage was substituted for the barley-and-pea forage of the preceding period — alfalfa forage being fed morning and night, and hay at noon and the same grain mixture (No. 19). The grain cost 53.6 per cent. of the cost of the ration and supplied 38.4 per cent. of the digestible nutrients. The forage represented 21.6 per cent. of the cost of the ration and supplied 37.3 per cent. of the digestible nutrients.

During the third period corn forage was fed morning and night and hay at noon. The mixed grain (No. 21) consisted of seven parts wheat bran, five parts ground oats, three parts corn meal and three parts linseed meal, O. P. The grain cost 55.3 per cent. of the cost of the ration and supplied 32.4 per cent. of the total digestible nutrients. The forage represented 20.6 per cent. of the cost of the ration and supplied 46.1 per cent. of the total digestible nutrients.

The cows gained little in weight during the first two periods, but much more during the third. In changing from the ration of the first period with barley-and-pea forage to that of the second with alfalfa forage, the nutritive ratio was made narrower — a change from 1:5.3 to 1:4.5; the total digestible protein remained about the same, and the digestible fat was reduced somewhat. The total organic matter and total digestible nutrients in the second ration were also considerably less, and the fuel value was lower. The cost of the ration was lower, and the cost of milk, milk-solids and fat somewhat less. There was no falling off in the milk yield, but, on the contrary, a slight increase. The composition of the milk remained about the same, the slight change being toward improvement in quality. By substituting corn forage in the third period for alfalfa, and changing the grain, the nutritive ratio of the ration was made much wider and became 1:8.0. In the ration for the third period the total organic matter

TABLE III—A.

PERIOD.	AVERAGE PER DAY PER COW.							
	Average live weight per cow during period Lbs.	Water. Lbs.	Corn forage. Lbs.	Alfalfa forage. Lbs.	Barley- and-pea forage. Lbs.	Mixed hay. Lbs.	Mixed grain. No. 19. Lbs.	Total dry matter in food. Lbs.
September 1 to 15 .....	866.2	59.33	.....	.....	32.47	6.34	6.63	45.44
September 16 to 30 .....	868.3	81.41	.....	27.23	.....	6.27	6.66	40.16
October 1 to 15 .....	886.3	65.99	26.85	.....	.....	6.28	No. 21. 6.60	39.73
October 16 to 30 .....								19.88
October 31 to 1 .....								18.38
October 1 to 15 .....								19.36

## B.

PERIOD.	AVERAGE PER DAY PER COW.								
	Moisture in food. Lbs.	Ash in food. Lbs.	Protein in food. Lbs.	Fats in food. Lbs.	Crude fibres in food. Lbs.	N. free extract in food. Lbs.	Total organic matter in food. Lbs.	Total digestible nutrients in food. Lbs.	Ratio of total protein to total carbohydrates in food (Fats x 2.4.)
September 1 to 15 .....	25.56	1.21	3.13	.81	4.21	10.53	18.67	12.93	1:5.3
September 16 to 30 .....	21.78	1.36	3.19	.72	3.75	9.37	17.02	11.22	1:4.6
October 1 to 15.....	20.37	.83	2.17	.70	3.65	12.00	18.54	12.66	1:7.9

## REPORT OF THE FIRST ASSISTANT OF THE

C.

PER 1,000 POUNDS LIVE WEIGHT FED.

PERIOD.	Nutritive ratio.	Digestible protein. Lbs.	Digestible fibre. Lbs.	Digestible N. free extract. Lbs.	Digestible fat. Lbs.	Total digestible nutrients. Lbs.	Total organic matter in ration. Lbs.	Calories of energy in ration. Oal.
September 1 to 15.....	1:5.3	2.52	3.20	8.55	.66	14.93	21.55	29327
September 16 to 30.....	1:4.6	2.46	2.15	7.72	.59	12.92	19.60	25424
October 1 to 15.....	1:8.0	1.67	2.53	9.52	.56	14.28	20.92	27882

D.

PERIOD.	AVERAGE PER DAY PER COW.					Total solids in milk. Lbs.
	Per cent. ash in milk.	Per cent. fat in milk.	Per cent. casein and albumen in milk.	Per cent. sugar in milk.	Ash in milk. Lbs.	
September 1 to 15 .....	.76	4.12	3.57	4.74	.11	.69
September 16 to 30 .....	.75	4.21	3.60	5.03	.11	.74
October 1 to 15.....	.78	4.10	4.16	4.76	.11	.72
						1.92
						2.00
						2.08

E.

PERIOD.	Total cost of food; average per day per cow. Cents.	Milk yield; average per day per cow. Lbs.	Pounds of water-free food consumed for one pound of milk produced. Lbs.	Pounds of water-free food consumed for one pound of milk solids produced. Lbs.	Pounds of water-free food consumed for one pound of fat produced. Lbs.	Cost of food for one pound of milk. Cents.	Cost of food for one pound of milk solids. Cents.	Cost of food for one pound of fat in milk. Cents.
September 1 to 15.....	13.16	14.56	1.37	10.35	33.13	.90	6.85	21.93
September 16 to 30.....	13.62	14.71	1.35	9.19	29.65	.86	6.31	20.35
October 1 to 15.....	13.01	15.14	1.28	9.31	31.23	.86	6.25	20.98

The greatest average daily yield of milk for the second period was 24.5 pounds and the smallest 9.0 pounds. The highest average per cent. of fat was 6.15 and the lowest 2.73. For the third period the extremes in milk yield were 35.1 pounds and 9.6 pounds, and in percentage of fat 5.65 and 2.55.

The composition of each food used is shown in the following tabulated form. The analyses of the barley-and-pea forage, the mixed hay and of mixed grain (No. 19) are given on page 197.

	Moisture. Per cent.	Ash. Per cent.	Protein. Per cent.	Crude fibre. Per cent.	Nitrogen free extract. Per cent.	Fats. Per cent.	IN WATER-FREE SUBSTANCES.	
							Total nitrogen. Per cent.	Albuminoid nitrogen. Per cent.
Alfalfa forage .....	74.5	2.8	5.3	6.6	10.1	.9	3.26	2.68
Corn forage .....	69.9	1.0	2.1	5.9	20.1	1.0	1.13	1.09
Mixed grain, No. 21.....	11.7	4.0	15.7	8.1	56.1	4.4	2.85	2.68

TABLE IV—A.

PERIOD.	AVERAGE PER DAY PER COW.								
	Average weight per cow during period. Lbs.	Water. Lbs.	Corn silage. Lbs.	Alfalfa forage. Lbs.	Oat-and-pea forage. Lbs.	Mixed hay. Lbs.	Mixed grain No. 25. Lbs.	Total food. Lbs.	Total dry matter in food. Lbs.
May 16 to 31 .....	868.3	70.32	15.90	.....	.....	10.80	5.84	32.54	19.37
June 1 to 30 .....	852.6	63.72	.....	44.66	.....	5.44	No. 25. 6.29	56.39	19.26
July 1 to 15 .....	859.9	61.13	.....	.....	50.08	5.38	6.21	61.67	23.42

## B.

PERIOD.	AVERAGE PER DAY PER COW.								
	Moisture in food. Lbs.	Ash in food. Lbs.	Protein in food. Lbs.	Fats in food. Lbs.	Crude fibre in food. Lbs.	N. free extract in food. Lbs.	Total or- ganic mat- ter in food. Lbs.	Total digestible nutrients. Lbs.	Ratio of total protein to total carbohydrates in food. (Fats 25%.)
May 16 to 31 .....	13.17	1.11	2.40	.16	4.37	10.52	18.26	11.18	1:7.1
June 1 to 30 .....	37.13	1.39	2.69	1.17	4.33	9.68	17.87	11.91	1:6.2
July 1 to 15 .....	28.25	1.39	2.62	1.39	5.49	12.52	22.03	15.67	1:8.1

## C.

PERIOD.	Nutritive ratio. (Fats x24.)	PER 1,000 POUNDS LIVE WEIGHT FED.						
		Digestible protein. Lbs.	Digestible fibre. Lbs.	Digestible N. free extract. Lbs.	Digestible fat. Lbs.	Total digestible nutrients. Lbs.	Total organic matter in ration. Lbs.	Calories of energy in ration. Cal.
May 16 to 31.....	1:7.1	1.72	2.58	- 7.79	.81	12.90	21.03	25906
June 1 to 30 .....	1:6.0	2.17	2.50	8.33	.97	13.97	20.96	28273
July 1 to 15 .....	1:8.0	2.19	4.42	10.45	1.16	18.22	25.62	36627

## D.

PERIOD.	AVERAGE PER DAY PER COW.					
	Per cent. of ash in milk.	Per cent. of fat in milk.	Per cent. of casein and albumen in milk.	Per cent. of sugar in milk.	Fat in milk. Lbs.	Casein and albumen in milk. Lbs.
May 16 to 31.....	.67	4.09	3.18	5.99	.14	.85
June 1 to 30.....	.67	3.87	3.20	5.90	.14	.82
July 1 to 15.....	.74	3.61	3.15	5.80	.15	.75
					Sugar in milk. Lbs.	Total solids in milk. Lbs.
					1.25	2.90
					1.25	2.89
					1.20	2.75

## L.

PERIOD.	Total cost of food; aver- age per day per cow. Cents.	Milk yield; average per day per cow. Lbs.	Pounds of water-free food con- sumed for one pound of milk pro- duced. Lbs.	Pounds of water-free food con- sumed for one pound of milk- solids pro- duced. Lbs.	Pounds of water-free food con- sumed for one pound of fat produced. Lbs.	Cost of food for one pound of milk. Cents.	Cost of food for one pound of milk-solids. Cents.	Cost of food for one pound of fat in milk. Cents.
May 16 to 31.....	14.35	20.86	.93	6.68	22.79	.69	4.95	16.88
June 1 to 30.....	14.91	21.20	.91	6.66	23.49	.70	5.16	18.18
July 1 to 15.....	15.32	20.72	1.13	8.52	31.23	.74	5.57	20.43

and the total digestible nutrients were increased together with a little increase in the cost of the ration; the fuel value was higher, the digestible fat remained about the same and the amount of protein was much less. The milk yield, however, was slightly increased. The cost of milk was the same and the cost of fat was a little higher.

In table IV are given the results obtained in a feeding trial from May 15 to July 15, 1892. During June alfalfa forage was fed, and for comparison with the results obtained then, those of the 15 days preceding and for the 15 days following are given. Fourteen cows were used in this feeding trial of the average age at its beginning of 3.4 years. They had been in milk on the average 3.6 months when the trial began.

From May 16 to 31, inclusive, corn silage was fed at noon, mixed hay morning and night and a mixed grain (No. 25) — consisting of six parts wheat bran, two parts ground oats, two parts wheat middlings, one part linseed meal, O. P. and three parts cottonseed meal. The same ration had also been fed for the first part of the month. Of the cost of the ration, 45.8 per cent. was represented by the grain, 16.6 per cent. by the silage. Of the total digestible nutrients, the grain supplied 32.1 per cent. and the silage 26 per cent.

From June 1 to June 30, alfalfa forage was fed morning and noon, hay at night, and a mixed grain (No. 26) which consisted of six parts ground oats, three parts corn meal, and two parts cottonseed meal. Of the cost of the ration the grain represented 51.8 per cent., and the forage 30.0 per cent. The grain supplied 34.6 per cent. of the digestible nutrients and the forage supplied 45.6 per cent.

From July 1 to July 15 the oat-and-pea forage was fed morning and noon, and hay at night. The same kind of mixed grain was fed as during June. The grain represented 49.7 per cent. of the cost of the ration, and the forage 32.7 per cent. The grain supplied 26.0 per cent. of the digestible nutrients and the forage 59.1 per cent.

During the first period the cows lost in weight an average of over 15 pounds. During the second, an average of 16 pounds, and gained during the third, about 30 pounds on the average. For the first period the greatest daily average milk yield was 30.7 pounds, and the smallest, 14.5 pounds. The highest average

per cent. of fat was 5.85, and the lowest, 3.28 per cent. For the second period the extremes in daily average milk yield were 32.0 pounds and 12.0 pounds, and the extremes in average percentage of fat were 6.18 and 2.98. For the third period the extremes were 31.3 pounds and 12.9 pounds, and 5.02 per cent. and 2.47 per cent.

In changing from the ration of the first period to that of the second, the nutritive ratio was changed from 1:7.1 to 1:6.0 although a larger amount of a less nitrogenous grain was fed in the second ration. The cost of the ration was somewhat greater in the second period, owing to the rather costly grain mixture used. The total dry matter and organic matter in the ration remained about the same, although there was an increase in total digestible nutrients. There was an increase of the protein and of the fat in the second ration, and the fuel value was higher. The yield of milk increased somewhat, but the amount of the different constituents remained the same, although there was a slight decrease in the per cent. of fat. The cost of milk was about the same as for the first period and the cost of fat somewhat higher.

In the third period, oat-and-pea forage was substituted for the alfalfa of the second, making the nutritive ratio much wider, although the same kind of grain was fed and the same kind of hay. In the ration for the third period there was considerable increase of the total dry matter, the digestible nutrients, and of the fuel value, the cost also being increased. There was considerably more digestible fat and about the same amount of protein. There was about the normal decrease in milk yield, but accompanied by a slight falling off in total solids, more noticeable in the per cent. of fat. The cost of milk and fat production was greater in the third period. In the following tabulated form will be found the composition of the different foods used in this trial.

	Moisture. Per cent.	Ash. Per cent.	Protein. Per cent.	Crude fibre Per cent.	Nitrogen free extract Per cent.	Fats Per cent.	IN WATER-PASTE SUBSTANCE.	
							Total nitrogen. Per cent.	Albuminoid nitrogen. Per cent.
Corn silage .....	71.0	1.0	2.5	5.4	18.4	1.5	1.40	1.03
Alfalfa forage.....	80.1	2.0	2.8	5.2	2.5	1.4	.....	.....
Oat-and-pea forage .....	73.7	1.8	2.4	7.0	13.4	1.7	.....	.....
Mixed hay.....	11.7	5.9	7.9	29.2	41.9	3.4	1.43	1.32
Mixed grain, No. 25 .....	10.7	4.8	19.7	6.2	52.6	6.0	3.53	3.52
Mixed grain, No. 26 .....	11.5	2.8	16.0	6.6	57.3	5.8	.....	.....

In table V are shown the results obtained during August, 1892, in feeding alfalfa forage and oat and pea forage. Ten cows were used in this trial, of 3.5 years average age August 1, at which time they had been in milk on the average about four months. The same hay and grain were fed throughout the trial — alfalfa forage was fed during the first part and oat and pea forage during the latter part. From August 1 to 13, inclusive, alfalfa forage was fed morning and noon, hay at night, and a mixed grain (No. 27) consisting of five parts wheat bran, two parts ground oats, three parts corn meal and two parts linseed meal, N. P. The grain represented 48.1 per cent. of the cost of the ration and supplied 30.2 per cent. of the digestible nutrients. The forage represented 34.2 per cent. of the cost of the ration and supplied 53.3 per cent. of the digestible nutrients.

From August 14 to August 31, oat-and-pea forage was fed morning and noon, hay at night, and the same mixed grain as before. The grain represented 49.3 per cent. of the cost of the ration and the forage 32.9 per cent. The grain supplied 33.0 per cent. of the digestible nutrients and the forage 49.4 per cent. There was an average loss of weight during the whole month of 16 pounds.

In changing from alfalfa to oat-and-pea forage the nutritive ratio of the ration was made wider. There was a slight diminution in the amount of total digestible nutrients and in the fat, and considerable in the amount of protein. The fuel value of the ration was somewhat less. The cost of the ration was practically the same for both periods. In the second period there was considerable falling off in the milk yield, and in the amount of the milk constituents, although there was a slight improvement in the quality of the milk. The cost of milk and solids was increased.

The highest daily average milk yield for the first period was 28.8 pounds and the lowest 14.81 pounds. The highest average percentage of fat was 4.80 and the lowest 2.70. For the second period the extremes in daily average yield were 27.48 pounds and 13.63 pounds, and in percentage of fat 5.10 and 2.48.

The following table shows the composition of each food used:

TABLE V—A.

PERIOD.	Average live weight per cow during period. Lbs.	AVERAGE PER DAY PER COW.						Total dry matter in food. Lbs.
		Water. Lbs.	Alfalfa forage. Lbs.	Oat-and-pea forage. Lbs.	Mixed hay. Lbs.	Mixed grain. No. 27. Lbs.	Total food. Lbs.	
August 1 to 13 .....	862.0	73.56	48.99	.....	5.09	6.62	60.70	22.34
August 14 to 31 .....	864.0	62.65	.....	47.15	5.08	6.78	59.01	19.58

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## B.

PERIOD.	AVERAGE PER DAY PER COW.								Ratio of total protein to total carbohydrates in food. (Fats $\times \frac{1}{4}$ )
	Moisture in food. Lbs.	Ash in food. Lbs.	Protein in food. Lbs.	Fats in food. Lbs.	Crude fibre in food. Lbs.	Nitrogen free extract in food. Lbs.	Total organic matter in ration. Lbs.	Total digestible nutrients. Lbs.	
August 1 to 13 .....	38.36	1.67	2.77	1.31	5.27	11.32	20.67	13.75	1:7.1
August 14 to 31 .....	39.43	1.15	2.18	1.20	4.34	10.70	18.43	12.88	1:8.1

C.

PERIOD.	Nutritive ratio (Fats x $\frac{3}{4}$ .)	PER 1,000 POUNDS LAYE WEIGHT FED.						Calories of energy in ration. Cal.
		Digestible protein. Lbs.	Digestible fibre. Lbs.	Digestible N. free extract. Lbs.	Digestible fat. Lbs.	Total digestible nutrients. Lbs.	Total organic matter in ration. Lbs.	
August 1 to 13 .....	1:6.8	2.20	3.09	9.64	1.02	15.95	23.98	32074
August 14 to 31 .....	1:7.8	1.85	3.37	8.90	.96	15.08	21.58	30314

D.

PERIOD.	AVERAGE PER DAY PER COW.						Total solids in milk. Lbs.
	Per cent of ash in milk.	Per cent of casein and albumen in milk.	Per cent of sugar in milk.	Ash in milk Lbs.	Casein and albumen in milk. Lbs.	Sugar in milk. Lbs.	
August 1 to 13 .....	.61	3.71	3.31	.13	.81	.70	2.76
August 14 to 31 .....	.60	3.82	3.28	.12	.73	.63	2.54

E.

PERIOD.	Total cost of food : average per day per cow. Cents.	Milk yield: average per day per cow. Lbs.	Pounds of water-free food consumed for one pound of milk produced. Lbs.	Pounds of water-free food consumed for one pound of milk solids produced. Lbs.	Pounds of water-free food consumed for one pound of fat in milk. Lbs.	Cost of food for one pound of milk. Cents.	Cost of food for one pound of milk-solids. Cents.	Cost of food for one pound of fat in milk. Cents.
August 1 to 13 .....	14.34	21.71	1.03	8.09	27.58	.66	5.20	17.70
August 14 to 31 .....	14.31	19.18	1.03	7.71	26.82	.75	5.63	19.60

	Moisture. Per cent.	Ash. Per cent.	Protein. Per cent.	Crude fibre. Per cent.	N free extract. Per cent.	Fats. Per cent.
Alfalfa forage.....	75.5	2.4	3.0	6.8	10.7	1.6
Oat-and-pea forage.....	80.7	1.4	1.8	5.1	9.6	1.4
Mixed hay.....	11.5	4.6	5.8	29.0	45.4	4.2
Mixed grain, No. 27.....	11.8	3.9	15.6	6.9	57.0	4.8

The results obtained in a feeding trial from September 1 to October 15, 1892, are shown in table VI. There was a change from oat-and-pea forage to alfalfa forage, and from alfalfa to corn silage. Ten cows were used in this trial of the average age, September 1, of 3.9 years, and had been in milk on the average, at that time, about five months.

TABLE VI--A.

PERIOD.	Average weight per cow during period. Lbs.	AVERAGE PER DAY PER COW.						
		Water. Lbs.	Corn silage. Lbs.	Alfalfa forage. Lbs.	Oat-and-pea forage. Lbs.	Mixed hay. Lbs.	Mixed grain, No. 27. Lbs.	Total food. Lbs.
September 1 to 15.....	877.0	56.63	.....	.....	52.07	5.54	7.42	65.03
September 16 to 30.....	885.5	72.53	.....	41.45	.....	5.69	7.48	54.62
October 1 to 15.....	898.0	60.40	37.57	.....	.....	5.85	7.39	50.75
								Total dry matter in food. Lbs.
								21.89
								20.34
								22.77

B.

PERIOD.	AVERAGE PER DAY PER COW.							
	Moisture in food. Lbs.	Ash in food. Lbs.	Protein in food. Lbs.	Fat in food. Lbs.	Crude fibre in food. Lbs.	N. free extract in food. Lbs.	Total organic matter in food. Lbs.	Ratio of total protein to total carbohydrates in food. (Fats x 2%).
September 1 to 15.....	48.14	1.27	2.39	1.32	4.78	11.75	30.62	1:8.2
September 16 to 30.....	34.28	1.59	3.21	1.18	4.20	10.16	18.75	1:5.3
October 1 to 15.....	27.98	1.03	2.60	1.31	4.57	13.26	21.74	1:8.0

C.

PERIOD.	PER 1,000 POUNDS LIVE WEIGHT FED.							
	Nutritive ratio.	Digestible protein. Lbs.	Digestible fibre. Lbs.	Digestible N. free extract. Lbs.	Digestible fat. Lbs.	Total digestible nutrients. Lbs.	Total organic matter in ration. Lbs.	Calories of energy in ration. Cal.
September 1 to 15.....	1:7.8	1.98	3.63	9.52	1.04	16.17	23.51	32531
September 16 to 30.....	1:5.1	2.51	2.35	8.29	.90	14.05	21.17	28257
October 1 to 15.....	1:8.3	1.84	2.80	9.88	1.12	15.64	24.21	31734

## D.

PERIOD.	Per cent. ash in milk.	Per cent. fat in milk.	Per cent. casein and albumen in milk.	Per cent. sugar in milk.	AVERAGE PER DAY PER COW.				
					Ash in milk. Lbs.	Fat in milk. Lbs.	Casein and albumen in milk. Lbs.	Sugar in milk. Lbs.	Total solids in milk. Lbs.
September 1 to 15 .....	.55	3.49	3.08	5.61	.11	.69	.61	1.11	2.53
September 16 to 30 .....	.56	3.26	3.19	5.36	.11	.65	.63	1.06	2.45
October 1 to 16 .....	.67	3.82	3.21	5.26	.13	.72	.61	.99	2.45

## E.

PERIOD.	Total cost of food; average per day per cow. Cents.	Milk; average per day per cow. Lbs.	Pounds of water-free food consumed for one pound of milk pro- duced. Lbs.	Pounds of water-free food consumed for one pound of milk- solids produced. Lbs.	Pounds of water-free food consumed for one pound of fat in milk. Lbs.	Cost of food for one pound of milk. Cents.	Cost of food for one pound of milk- solids. Cents.	Cost of food for one pound of fat in milk. Cents.
September 1 to 15 .....	15.71	19.70	1.11	8.69	31.72	.80	6.23	22.77
September 16 to 30 .....	14.77	19.74	1.03	8.30	31.29	.75	6.03	22.72
October 1 to 15 .....	17.09	18.75	1.21	9.29	31.63	.91	6.98	23.74

From September 1 to 15, oat-and-pea forage was fed morning and noon, hay at night, and a mixed grain, No. 27, consisting of five parts wheat bran, two parts ground oats, three parts corn meal and two parts linseed meal, N. P. The grain cost 49.2 per cent. of the cost of the ration and supplied 32.8 per cent. of the digestible nutrients. The forage represented 33.2 per cent. of the cost of the ration, and supplied 49.7 per cent. of the digestible nutrients.

From September 16 to 30, inclusive, alfalfa forage was fed morning and noon, and hay at night. The same mixed grain was fed as during the preceding period. The cost of the grain was 52.7 per cent. of the cost of the ration, and 37.7 per cent. of the digestible nutrients were supplied by the grain. The forage represented 28.0 per cent. of the cost of the ration, and supplied 41.9 per cent. of the digestible nutrients.

From October 1 to 15, corn silage was fed morning and noon, and hay at night. A mixed grain, No. 28, was fed, consisting of five parts wheat bran, three parts ground oats, two parts linseed meal, O. P., and two parts of cottonseed meal. The grain represented 49.8 per cent. of the cost of the ration, and supplied 30.1 per cent. of the total digestible nutrients. The silage represented 33.1 per cent. of the cost of the ration, and supplied 51.2 per cent. of the total digestible nutrients. There was an average gain in live weight of 17 pounds during the whole of September, and an average gain from October 1 to 15, of about 16 pounds.

In changing from oat and-pea forage to alfalfa forage the nutritive ratio of the ration was made much narrower. There was less fat in the second ration and more protein; the total digestible nutrients were less and the fuel value was lower. There was a decrease in the total cost of the food, but the milk yield remained about the same. The per cent. of fat in the milk was less. The cost of production was lower for milk and for total solids. The cost of fat produced was almost exactly the same. In changing from alfalfa forage to corn silage, although there was also some change in the grain, the nutritive ratio was made much wider, a change of from 1:5.1 to 1:8.3. There was an increase of total organic matter, total digestible nutrients and fat, but the protein was much less. There was considerable increase in the cost

of the ration and the fuel value was increased. There was a fairly normal decrease in the milk yield. There was an increase in the per cent. and in the amount of fat. The cost of milk, milk-solids, and fat was greater than for the third period. From September 1 to 15 the greatest daily average milk yield was 34.2 pounds and the smallest 12.4 pounds. The highest average per cent. of fat was 5.00 and the lowest 2.50. From September 16 to 30 the extremes were 36.7 pounds and 11.6 pounds of milk and 5.20 per cent. and 1.08 of fat. From October 1 to 15 the extremes were in milk yield 34.5 pounds and 10.6 pounds and in percentage of fat 5.90 and 2.40. The composition of the hay fed during this trial, of the oat-and-pea forage and of the mixed grain, No. 27, will be found on page 212. The composition of each of the other foods is shown in the following table:

	Moisture. Per cent.	Ash. Per cent.	Protein. Per cent.	Crude fibre. Per cent.	Nitrogen (free extract). Per cent.	Fat. Per cent.	IN WATER-FREE SUB- STANCE.	
							Total nitrogen. Per cent.	Albuminoid nitrogen. Per cent.
Alfalfa forage .....	79.0	2.5	4.2	4.9	8.0	1.4	3.21	2.63
Corn silage.....	69.7	1.2	2.7	5.7	18.9	1.8	1.44	1.26
Mixed grain, No. 28.....	15.3	4.2	17.5	10.0	47.8	5.2	3.31	3.06

The results obtained in a feeding trial from May 17 to July 15, 1893, are shown in table VII. There was a change from corn silage to rye and alfalfa forage, then to alfalfa forage and finally to oat-and-pea forage. Ten cows were used of the average age June 1 of 4.8 years. They had been in milk at that date about 4.5 months.

From May 17 to May 31, inclusive, corn silage was fed morning and noon, and hay at night. The grain fed, No. 31, consisted of six parts of wheat bran, one part ground oats, two parts corn meal, two parts wheat middlings, one part linseed meal, O. P., and one part cottonseed meal. This same ration had been fed for several weeks preceding. The cost of grain was 45.4 per cent. of the cost of the ration and the grain supplied 40.2 per cent. of the digestible nutrients. The silage represented 35.6 per cent. of the cost of the ration and supplied 35.5 per cent of the digestible nutrients.

From June 1 to June 10 alfalfa forage was fed in the morning, rye forage at noon, and hay at night. The mixed grain, No. 32, consisted of five parts wheat bran, one part ground oats, four parts corn meal, one part wheat middlings and one part linseed meal, N. P. The grain represented 50.6 per cent. of the cost of the ration and the forage 27.3 per cent. The grain supplied 34.5 per cent. of the total digestible nutrients and the forage, 45.2 per cent.

From June 11 to June 30, inclusive, alfalfa forage was fed in the morning and at noon, and hay at night. The same mixed grain, No. 32, was fed. The grain represented 47.5 per cent. of the cost of the ration and the forage 33.7 per cent. The grain supplied 32.7 per cent. of the total digestible nutrients and the forage supplied 49.8 per cent.

From July 1 to 15 oat-and-pea forage was fed in the morning and at noon, and a mixed hay at night. Mixed grain, No. 32, was again fed. The grain represented 48.4 per cent. of the cost of the ration and the forage 35.3 per cent. The grain supplied 36.7 per cent. of the total digestible nutrients and the forage 46.2 per cent. There was an average loss in weight during the first period of 16.5 pounds and a slight average gain during each of the other three periods of a little over one pound.

TABLE VII—A.

PERIOD.	AVERAGE PER DAY PER COW.							
	Average live weight per cow during period. Lbs.	Water. Lbs.	Corn silage. Lbs.	Alfalfa forage. Lbs.	Out-and-pea forage. Lbs.	Mixed hay. Lbs.	Mixed grain No. 31. Lbs.	Total dry matter in food. Lbs.
May 17 to 31 .....	942.2	64.16	36.15	.....	.....	5.78	6.65	48.58
June 1 to 10 .....	934.8	73.26	Bye forage. 17.83	20.48	.....	6.08	No. 32. 6.96	51.35
June 11 to 30 .....	936.2	78.27	.....	48.75	.....	5.41	6.86	61.02
July 1 to 15 .....	937.5	66.82	.....	.....	54.56	5.06	7.49	67.11
								19.56
								19.86
								21.32
								19.50

## B.

PERIOD.	AVERAGE PER DAY PER COW.							
	Moisture in food. Lbs.	Ash in food. Lbs.	Protein in food. Lbs.	Fats in food. Lbs.	Crude fibre in food. Lbs.	N. free extract in food. Lbs.	Total organic matter in food. Lbs.	Ratio of total protein to total carbohydrates in foods. (Fats x 2.5.)
May 17 to 31 .....	29.02	.99	2.47	1.15	3.71	11.23	18.57	1:7.1
June 1 to 10 .....	31.49	1.30	2.66	1.05	4.73	10.24	18.66	1:6.5
June 11 to 30 .....	39.70	1.49	3.20	1.18	5.00	10.48	19.83	1:5.7
July 1 to 15 .....	47.61	1.34	3.67	1.08	4.15	9.89	18.16	1:5.4
							10.01	
							13.64	
							13.16	
							12.77	

## C.

PERIOD.	Nutritive ratio.	PER 1,000 POUNDS LIVE WEIGHT FED.						
		Digestible protein Lbs.	Digestible fibre. Lbs.	Digestible free extract. Lbs.	Digestible fat. Lbs.	Total digestible nutrients. Lbs.	Total organic matter in ration. Lbs.	Calories of energy in ration. Cal.
May 17 to 31.....	1:6.5	1.56	2.22	5.94	.90	10.62	19.71	21877
June 1 to 10.....	1:6.6	1.89	2.98	7.91	.74	13.52	19.96	26894
June 11 to 30.....	1:5.7	2.26	2.70	8.26	.83	14.05	21.18	28091
July 1 to 15.....	1:5.4	2.30	2.94	7.59	.79	13.62	19.37	27198

## D.

PERIOD.	AVERAGE PER DAY PER COW.								
	Per cent. ash in milk.	Per cent. fat in milk.	Per cent. casein and albumen in milk.	Per cent. sugar in milk.	Ash in milk. Lbs.	Fat in milk. Lbs.	Casein and albumen in milk. Lbs.	Sugar in milk. Lbs.	Total solids in milk. Lbs.
May 17 to 31 .....	.66	4.47	3.96	5.12	.16	1.10	.97	1.26	3.49
June 1 to 10 .....	.57	4.39	3.69	5.15	.13	1.01	.85	1.19	3.18
June 11 to 30 .....	.61	4.42	3.89	5.08	.14	1.00	.88	1.14	3.16
July 1 to 15 .....	.63	4.28	3.91	5.15	.14	.97	.89	1.17	3.12

## E.

PERIOD.	Total cost of food; average per day per cow. Cents.	Milk yield; average per day per cow. Lbs.	Pounds of water-free food consumed for one pound of milk produced. Lbs.	Pounds of water-free food consumed for one pound of milk solids produced. Lbs.	Pounds of water-free food consumed for one pound of fat produced. Lbs.	Cost of food for one pound of milk. Cents.	Cost of food for one pound of milk solids. Cents.	Cost of food for one pound of fat in milk. Cents.
May 17 to 31.....	15.21	24.53	.76	5.60	17.78	.62	4.35	13.83
June 1 to 10.....	13.75	23.05	.86	6.25	19.66	.60	4.32	13.61
June 11 to 30.....	14.45	22.53	.95	6.75	21.32	.64	4.57	14.45
July 1 to 15.....	15.48	22.69	.86	6.25	20.10	.68	4.96	15.96

The ration for the second period had almost the same nutritive ratio as that of the first. There was a considerably greater amount of total digestible nutrients in the second ration, although the total organic matter was about the same. The fuel value of the second ration was higher and the cost was less. There was a greater amount of protein and less fat. There was about a normal decrease in milk yield. The cost of milk and of fat was about the same for both periods. The nutritive ratio was made somewhat narrower when rye forage was discontinued and more alfalfa fed; the total organic matter and the digestible nutrients were somewhat increased, also the fuel value and the cost of the ration. There was considerable increase in the amount of protein. There was a slight decrease in the milk yield, probably less than the normal. The milk and its fat cost somewhat more. In changing from alfalfa to oat-and-pea forage more forage and grain were fed; the amount of digestible protein remained about the same, but there was a little falling off in the total nutrients. The cost of the ration was somewhat greater, also the cost of the milk and fat — although there was no falling off in milk yield.

For the first period the greatest daily average milk yield was 35.3 pounds and the smallest 15 pounds. The highest average per cent. of fat was 6.47 and the lowest 3.05. For the second period the extremes in average daily milk yield were 34.9 pounds and 13.2 pounds and in percentage of fat 6.30 and 3.00. For the third period the extremes were 35.3 pounds and 12.7 pounds of milk, and 6.25 and 3.00 per cent. of fat. For the fourth period the extremes were 35.5 pounds and 13.1 pounds, and 6.15 per cent. and 2.77 per cent. of fat. In the following table will be found the composition of each food used.

	Moisture. Per cent.	Ash. Per cent.	Protein Per cent.	Crude fiber. Per cent.	N free extract. Per cent.	Fat. Per cent.	IN WATER-FREE SUBSTANCE.	
							Total nitrogen. Per cent.	Albuminoid nitrogen. Per cent.
Corn silage .....	75.4	1.2	2.5	4.9	14.4	1.6	1.59	1.06
Rye forage .....	76.9	1.4	2.5	7.8	10.2	1.3	1.73	1.49
Alfalfa forage .....	77.9	2.0	3.8	6.5	8.4	1.4	2.72	2.17
Oat-and-pea forage .....	84.2	1.5	3.1	4.2	5.9	1.1	3.14	2.23
Mixed hay (May 17 to June 30) .....	14.5	4.9	9.0	27.2	39.5	4.9	1.69	1.58
Mixed hay (July 1 to 31) .....	12.6	5.1	8.7	28.6	40.4	4.6	1.60	1.50
Mixed grain, No. 31 .....	13.8	4.2	15.8	5.6	56.3	4.3	2.93	2.82
Mixed grain, No. 32 .....	13.7	3.5	12.5	5.2	61.8	3.3	.....	.....
Alfalfa forage (fed July 16 to 31) .....	74.9	2.2	4.3	7.9	9.3	1.4	2.73	2.06

The results obtained with nine cows during July, 1893, are given in table VIII. The average age of the cows was 4.9 years and the average time in milk 4.2 months. For the first half of the month oat-and pea forage was fed and for the latter half alfalfa forage. There was no change in the kind of hay or of grain throughout the month. Not quite so much hay or grain was fed with the alfalfa as with the oat-and-pea forage, which made the cost of the ration somewhat lower. Forage was fed in the morning and at noon, and hay at night; for the first period oat-and-pea forage and for the second alfalfa forage. The mixed grain (No. 32) consisted of five parts wheat bran, one part ground oats, four parts corn meal, one part wheat middlings and one part linseed meal, N. P. The grain represented 49.9 per cent. of the cost of the first ration and 48.9 per cent. of the cost of the second, and supplied 38.2 per cent. of the total digestible nutrients in the first and 29.9 per cent. in the second ration. The oat-and-pea forage represented 34 per cent. of the cost of the first ration and supplied 45.1 per cent. of the total digestible nutrients. The alfalfa forage represented 34.6 per cent. of the cost of the second ration and supplied 51.6 per cent. of the total digestible nutrients. There was an average gain in weight during the trial of a little more than 6 pounds.

The second ration contained a little more protein and fat and considerably more of total nutrients; the fuel value was higher, and the nutritive ratio nearly the same — a trifle wider. There was somewhat more than the normal falling off in the milk yield. The milk and the fat cost a little more for the second period than for the first. From July 1 to 15 the highest daily average milk yield was 35.5 pounds and the lowest 18.4 pounds. The highest average per cent. of fat was 5.60 and the lowest 2.77. From July 16 to 31 the extremes in milk yield were 32.9 and 15.5 pounds, and in percentage of fat 5.80 and 2.85. In the small table on page 223 will be found the composition of each food used in this trial.

The results obtained from the same nine cows later in the season during a trial in which corn forage and alfalfa forage in one ration were substituted for oat-and-pea forage and part of the hay in the other are shown in table IX. The cows averaged in

TABLE VIII—A.

PERIOD.	Average live weight per cow during period. Lbs.	AVERAGE PER DAY PER COW.						
		Water. Lbs.	Alfalfa forage. Lbs.	Oat-and-pea forage. Lbs.	Mixed hay. Lbs.	Mixed grain. No. 32. Lbs.	Total food. Lbs.	Total dry matter in food. Lbs.
July 1 to 15 .....	918.2	70.12	.....	53.93	5.05	7.89	66.87	19.74
July 16 to 31 .....	916.6	87.29	52.08	.....	4.95	7.35	64.38	23.43

29

## B.

PERIOD.	AVERAGE PER DAY PER COW.							
	Moisture in food. Lbs.	Ash in food. Lbs.	Protein in food. Lbs.	Fats in food. Lbs.	Crude fibre in food. Lbs.	N. free extract in food. Lbs.	Total organic matter in food. Lbs.	Ratio of total protein to total carbohydrates in food. (Fats $\times \frac{1}{4}$ )
July 1 to 15 .....	47.13	1.35	3.10	1.08	4.12	10.10	18.39	1:5.4
July 16 to 31 .....	40.95	1.79	3.80	1.31	5.91	12.35	21.64	1:5.6

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C.

PERIOD.	Nutritive ratio.	PER 1,000 POUNDS LIVE WEIGHT FED.					
		Digestible protein. Lbs.	Digestible fibre. Lbs.	Digestible nitrogen free extract. Lbs.	Digestible fat. Lbs.	Total digestible nutrients. Lbs.	Total organic matter in milk. Lbs.
July 1 to 15.....	1:5.3	2.40	3.00	7.98	.80	14.18	20.14
July 16 to 31.....	1:5.6	2.72	3.29	9.83	.93	16.77	23.61
							28263
							33387

D.

PERIOD.	AVERAGE PER DAY PER COW.					
	Per cent. ash in milk	Per cent. fat in milk	Per cent. casein and albumen in milk.	Per cent. sugar in milk.	Ash in milk Lbs.	Fat in milk Lbs.
July 1 to 15.....	.64	4.26	3.83	5.20	.16	1.09
July 16 to 31 .....	.60	4.20	3.79	5.13	.14	.97
						.98
						1.33
						1.18
						3.56
						3.16

## E.

PERIOD.	Total cost of food; average per day per cow. Cents.	Milk yield; average per day per cow. Lbs.	Pounds of water-free food consumed for one pound of milk produced. Lbs.	Pounds of water-free food consumed for one pound of milk-solids produced. Lbs.	Pounds of water-free food consumed for one pound of fat produced. Lbs.	Cost of food for one pound of milk. Cents.	Cost of food for one pound of milk-solids produced. Cents.	Cost of food for one pound of fat in milk. Cents.
July 1 to 15.....	15.81	25.64	.77	5.54	18.11	.62	4.44	14.60
July 16 to 31 .....	15.04	23.02	1.02	7.41	24.15	.65	4.76	15.51

TABLE IX—A.

PERIOD.	AVERAGE PER DAY PER COW								
	Average weight per cow during period. Lbs.	Water. Lbs.	Corn forage. Lbs.	Alfalfa forage. Lbs.	Oat- and-pea forage. Lbs.	Mixed hay. Lbs.	Mixed grain, No. 34. Lbs.	Total food. Lbs.	Total dry matter in food. Lbs.
August 17 to 31 .....	926.5	92.81	.....	.....	27.74	12.14	8.03	47.91	22.87
September 1 to 15 .....	933.1	75.41	28.74	24.82	.....	5.64	7.26	66.46	25.59

## B.

PERIOD.	AVERAGE PER DAY PER COW.							
	Moisture in food. Lbs.	Ash in food. Lbs.	Protein in food. Lbs.	Fats in food. Lbs.	Crude fibre in food. Lbs.	N. free extract in food. Lbs.	Total organic matter in ration. Lbs.	Ratio of total protein to total carbohydrates in food. (Fats x 2½).
August 17 to 31 .....	25.04	1.59	3.45	1.58	5.37	10.92	21.28	1:5.8
September 1 to 15 .....	40.87	1.30	3.29	1.43	5.32	14.07	24.29	1:7.0

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**PER 1,000 POUNDS LIVE WEIGHT - FED.**

PERIOD.	Nutritive ratio.	PER 1,000 POUNDS LIVE WEIGHT FED.							Calories of energy in ration. Cal.
		Digestible protein. Lbs.	Digestible fibre. Lbs.	Digestible N. free extract. Lbs.	Digestible fat. Lbs.	Total digestible nutrients. Lbs.	Total organic matter in ration. Lbs.		
August 17 to 31. ....	1:5.8	2.51	3.22	8.77	1.19	15.69	22.97	31992	
September 1 to 15.....	1:6.8	2.52	3.33	11.04	1.24	18.13	26.03	36648	

Di

**AVERAGE PER DAY PER COW.**

PERIOD.	Per cent. ash in milk.	Per cent. fat in milk.	Per cent. casein and albumen in milk.	Per cent. sugar in milk.	AVERAGE PER DAY PER COW.				
					Ash in milk. Lbs.	Fat in milk. Lbs.	Casein and albumen in milk. Lbs.	Sugar in milk. Lbs.	Total solids in milk. Lbs.
August 17 to 31 .....	.62	4.65	3.92	5.10	.13	1.00	.85	1.10	3.08
September 1 to 15 .....	.60	4.49	3.93	5.18	.14	1.05	.92	1.21	3.32

## E.

PERIOD.	Total cost of food; average per day per cow. Cents.	Milk yield; average per day per cow. Lbs.	Pounds of water-free food consumed for one pound of milk pro- duced. Lbs.	Pounds of water-free food consumed for one pound of milk-solids produced. Lbs. •	Pounds of water-free food consumed for one pound of fat pro- duced. Lbs.	Cost of food for one pound of milk. Cents.	Cost of food for one pound of milk-solids. Cents.	Cost of food for one pound of fat in milk. Cents.
August 17 to 31 ....	18.08	21.57	1.06	7.43	22.87	.84	5.87	18.08
September 1 to 15 ....	16.51	23.30	1.10	7.71	24.37	.71	4.97	15.72

age a little over five years at the time of this feeding trial and had been in milk on the average about 5.6 months.

During the first period mixed clover hay was fed morning and night and oat-and-pea forage at noon. The mixed grain fed, No. 34, consisted of five parts wheat bran, two parts ground oats, five parts corn meal, one part wheat middlings, one part linseed meal, O. P., one part cottonseed meal, one part ground flaxseed and four parts gluten feed. The grain represented 31.1 per cent. of the cost of the ration and supplied 38.4 per cent. of the total digestible nutrients. The forage represented 15.4 per cent. of the cost of the ration and supplied 24.2 per cent. of the digestible nutrients. During the second period alfalfa forage was fed in the morning, mixed hay (very little clover) was fed at noon and corn forage at night. No change was made in the grain. The grain represented 50.5 per cent. of the cost of the ration and supplied 28.7 per cent. of the digestible nutrients. The forage represented 32.4 per cent. of the cost of the ration and supplied 56.8 per cent. of the total digestible nutrients. There was a small average gain in live weight during each period.

The second ration, having somewhat the wider nutritive ratio, contained the same amount of protein as the first, but more fat, considerably more total nutrients, and was considerably higher in fuel value. The cost of the second ration was somewhat lower. There was considerable increase in the average milk yield for the second period and the milk and fat cost less — although there was a slight decrease in average per cent. of fat in the milk. The extremes in daily average milk yield for the first period were 30.2 pounds and 12.8 pounds and in percentage of fat 6.10 and 2.80. The extremes for the second period were 31.9 and 16.2 pounds average daily milk yield, and 6.70 and 2.90 average per cent. of fat. The foods used showed the composition given in the following table:

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	Moisture Per cent.	Ash. Per cent.	Protein. Per cent.	Crude fibre Per cent.	N. free extract Per cent.	Fats. Per cent.	IN WATER-FREE SUB- STANCE.	
							Total nitrogen. Per cent.	Albuminoid nitrogen. Per cent.
Oat-and-pea forage .....	81.8	2.3	4.0	4.4	6.2	1.4	3.47	2.44
Corn forage .....	73.4	1.1	2.2	4.9	17.0	1.4	1.34	1.15
Alfalfa forage .....	73.3	2.0	4.7	7.5	10.9	1.6	2.81	2.15
Mixed hay (August 17 to 31) .....	12.4	5.7	8.4	30.0	39.1	4.5	1.53	1.44
Mixed hay (September 1 to 15) .....	14.5	4.3	5.2	28.2	43.4	4.5	.98	.93
Mixed grain, No. 34 .....	10.5	3.3	16.5	6.3	55.4	8.0	2.95	2.92

The results of a feeding trial during May, 1894, are given in table X. Nine cows were used of the average age of 4.7 years. The average time they had been in milk by May 1 was 4.4 months. With one kind of grain fed throughout, there was a change from corn silage and hay to more of alfalfa forage and less hay, with an interval of five days in which both silage and forage were fed with the hay. For some weeks preceding this trial the ration had been very similar to that fed for the first period here reported.

For the first period corn silage was fed at noon, clover hay morning and night and a mixed grain, No. 38, consisting of five parts wheat bran, two parts corn meal, one part wheat middlings, one part cotton-seed meal and one part gluten feed. The grain cost 41.6 per cent. of the cost of the ration and supplied 33.9 per cent. of the total digestible nutrients. The silage represented 21.4 per cent. of the cost of the ration and supplied 24.7 per cent. of the total digestible nutrients.

For the second short period corn silage was fed in the morning, alfalfa forage at noon and clover hay at night. The grain cost 44.1 per cent. of the cost of the ration and supplied 34.3 per cent. of the total digestible nutrients. The silage and forage represented 33.3 per cent. of the cost and supplied 42.6 per cent. of the digestible nutrients. For the third period alfalfa forage was fed morning and noon, clover hay at night and the same grain, No. 38, was fed. The grain represented 43.5 per cent. of the cost of the ration and supplied 30.3 per cent. of the total digestible nutrients. The forage represented 33.7 per cent. of the cost of the ration and supplied 48.0 per cent. of the total digestible nutrients. There was considerable average loss in weight during each period, the average loss in weight per cow for the month being 38.7 pounds.

The ration for the last period had a much narrower ratio than that of the first. There was an increase in the amount of digestible protein, fat and total nutrients, and the fuel value was higher. The cost of the ration was somewhat lower. The milk yield for the last period was about the same, with a slight improvement in quality. The cost of milk and fat was less. The results in the short intermediate period were somewhat better than in the first or last. For the first period the greatest daily average milk yield was 34.9 pounds and the smallest 19.2 pounds. The highest average per cent. of fat was 7.00 and the lowest 3.05. For

TABLE X. A.

PERIOD.	Average live weight per cow during period. Lbs.	AVERAGE PER DAY PER COW.						Total dry matter in food. Lbs.
		Water. Lbs.	Corn silage Lbs.	Alfalfa forage. Lbs.	Mixed clover. Lbs.	Mixed grain, No. 88. Lbs.	Total food. Lbs.	
May 1 to 10 .....	997.5	81.89	22.99	.....	11.95	6.79	41.73	21.50
May 11 to 15 .....	987.0	69.77	20.39	19.76	6.62	6.81	53.48	20.44
May 16 to 31 .....	974.0	53.23	.....	49.88	6.72	6.49	63.09	22.15

## B.

PERIOD.	AVERAGE PER DAY PER COW.							
	Moisture in food. Lbs.	Ash in food. Lbs.	Protein in food. Lbs.	Fats in food. Lbs.	Crude fibre in food. Lbs.	N free extract in food. Lbs.	Total organic matter in food. Lbs.	Ratio of total protein to total carbohydrates in food. (Fats x $\frac{2}{3}$ .)
May 1 to 10 .....	20.23	1.22	2.65	.84	5.81	11.96	20.28	1:7.4
May 11 to 15 .....	33.04	1.37	3.17	.94	4.05	10.91	19.07	1:5.4
May 16 to 31 .....	40.94	1.82	4.28	1.12	4.31	10.62	20.33	1:4.1

## C.

PERIOD.	Nutritive ratio.	PER 1,000 POUNDS LIVE WEIGHT FED.						Calories of energy in milk. Cal.
		Digestible protein. Lbs.	Digestible fibre. Lbs.	Digestible N. free extract. Lbs.	Digestible fat. Lbs.	Total digestible nutrients. Lbs.	Total organic matter in food. Lbs.	
May 1 to 10.....	1:7.4	1.58	2.50	7.86	.62	12.56	20.34	24825
May 11 to 15.....	1:5.5	2.09	2.16	7.66	.70	12.61	19.32	25107
May 16 to 31.....	1:4.0	2.96	2.20	7.83	.79	13.78	20.87	27495

## D.

PERIOD.	AVERAGE PER DAY PER COW.						Total solids in milk. Lbs.
	Per cent each in milk	Per cent fat in milk	Per cent casein and albumen in milk.	Per cent sugar in milk.	A lb in milk. Lbs.	Fat in milk Lbs.	
May 1 to 10.....	.63	4.25	3.79	5.11	.14	.96	3.10
May 11 to 15.....	.63	4.47	3.62	4.36	.16	1.11	3.25
May 16 to 31.....	.61	4.45	3.87	5.19	.14	1.00	3.18

E.

PERIOD.	Total cost of food; average per day per cow. Centa.	Milk yield; average per day per cow. Lbs.	Pounds of water free food consumed for one pound of milk produced. Lbs.	Pounds of water-free food for one pound of fat produced. Lbs.	Cost of food for one pound of milk. Centa.	Cost of food for one pound of milk solids. Centa.	Cost of food for one pound of fat in milk. Centa.
May 1 to 10.....	16.13	22.51	.96	6.94	.72	5.20	16.80
May 11 to 15.....	15.07	24.81	.82	6.39	.61	4.64	13.58
May 16 to 31.....	14.78	22.44	.99	6.96	.66	4.65	14.78

In the following table is found the composition of each food used :

	Moisture. Per cent.	Ash. Per cent.	Protein. Per cent.	Crude fibre. Per cent.	N. free extract. Per cent.	Fats. Per cent.	IN WATER-FREE SUBSTANCE.	
							Total nitrogen. Per cent.	Albuminoid nitrogen. Per cent.
Corn silage.....	77.9	1.4	2.0	4.8	13.1	.8	1.45	.97
Alfalfa forage.....	78.8	2.4	5.2	4.1	8.3	1.2	3.89	2.92
Clover hay.....	12.4	5.3	8.6	27.3	44.1	2.3	1.57	1.40
Mixed grain, No. 38...	12.3	4.0	17.1	6.7	54.2	5.7	3.12	2.83

**TABLE XI—A.**

PERIOD.	Average live weight per cow during period. Lbs.	AVERAGE PER DAY PER COW.						Total dry matter in food. Lbs.
		Water. Lbs.	Alfalfa forage. Lbs.	Out-and-pee forage. Lbs.	Mixed hay. Lbs.	Mixed grain, No. 38. Lbs.	Total food. Lbs.	
June 1 to 30 .....	995.6	82.63	53.36	.....	6.35	6.27	65.98	24.38
July 1 to 31 .....	1002.4	89.03	.....	53.28	6.11	5.97	64.36	27.76

## B.

PERIOD.	AVERAGE PER DAY PER COW.							
	Moisture in food. Lbs.	Ash in food. Lbs.	Protein in food. Lbs.	Fats in food. Lbs.	Crude fibre in food. Lbs.	N. free extract in food. Lbs.	Total organic matter in food. Lbs.	Total digestible protein to total carbohydrates in food. (Fats x 2 1/4.)
June 1 to 30.....	41.60	1.59	3.24	1.00	5.72	12.85	22.79	1:6.4
July 1 to 31.....	36.60	1.49	3.51	1.06	6.08	15.61	26.27	1:6.9

## C.

PERIOD.	Nutritive ratio.	PER 1,000 POUNDS LIVE WEIGHT FED						Calories of energy in ration. Cal.
		Digestible protein. Lbs.	Digestible fibre. Lbs.	Digestible & free extract. Lbs.	Digestible fat. Lbs.	Total digestible nutrients. Lbs.	Total organic matter in ration. Lbs.	
June 1 to 30 .....	1:6.6	2.12	2.91	9.52	.68	15.23	22.89	29933
July 1 to 31 .....	1:7.0	2.44	4.28	11.17	.74	18.63	26.21	36398

## D.

PERIOD.	AVERAGE PER DAY PER COW.						Total solids in milk. Lbs.
	Per cent. ash in milk.	Per cent. fat in milk.	Per cent. casein and albumen in milk.	Per cent. sugar in milk.	Ash in milk. Lbs.	Casein and albumen in milk. Lbs.	
June 1 to 30 .....	.61	3.88	3.76	5.24	.17	1.03	3.89
July 1 to 31 .....	.61	3.77	3.59	5.25	.15	.91	3.85

E.

PERIOD.	Total cost of food; average per day per cow. Cents.	Milk yield; average per day per cow. Lbs.	Pounds of water-free food consumed for one pound of milk produced. Lbs.	Pounds of water-free food consumed for one pound of milk solids produced. Lbs.	Pounds of water-free food consumed for one pound of fat produced. Lbs.	Cost of food for one pound of milk. Cents.	Cost of food for one pound of milk-solids. Cents.	Cost of food for one pound of fat in milk. Cents.
June 1 to 30 .....	14.67	27.32	.89	6.61	23.00	.54	3.98	13.84
July 1 to 31 .....	14.20	25.38	1.09	8.29	28.92	.56	4.24	14.79

the second period the extremes were 36.1 pounds and 15.7 pounds in milk yield and 6.72 and 3.00 in average per cent. of fat. For the third period the extremes in daily average milk yield were 29.1 pounds and 15.2 pounds and in the average percentage of fat 6.45 and 3.10.

The results of another feeding trial in which eight cows were fed from June 1 to July 31, 1894, are given in Table XI. Alfalfa forage was fed during June, and oat-and-pea forage during July, mixed clover hay during both months, and one kind of mixed grain. From June 1 to 30 alfalfa forage was fed morning and noon and clover hay at night. The mixed grain, No. 39, consisted of five parts wheat bran, one part ground oats, five parts corn meal and one part wheat middlings. The grain represented 41.9 per cent. of the cost of the ration and supplied 27.2 per cent. of the total digestible nutrients. The forage represented 36.4 per cent. of the cost of the ration and supplied 54.5 per cent. of the total digestible nutrients. From July 1 to 31 oat-and-pea forage was fed morning and noon, and hay at night; the same mixed grain morning and night as before. The grain represented 41.6 per cent. of the total cost of the ration and supplied 20.8 per cent. of the total digestible nutrients. The forage represented 36.8 per cent. of the total cost of the ration and supplied 64.8 per cent. of the total digestible nutrients. The ration for the second period had a little wider nutritive ratio than that for the first. There was an increase in the amount of each digestible constituent and an increase of the fuel value. The cost of the ration was somewhat less. There was a decrease in milk yield at about the normal rate; the percentage of fat was, however, slightly lower. There was a slight increase in the cost of milk and more in the cost of fat. The average gain in weight per cow for June was 11.6 pounds and for July two pounds.

The greatest daily average milk yield for June was 31.9 pounds and the least 22.7 pounds. The highest average per cent. of fat was 4.69 and the lowest 3.20. For July the greatest daily average milk yield was 34.4 pounds and the least 16.4 pounds. The highest average per cent. of fat was 5.25 and the lowest 2.99. The following table shows the composition of each food used in this trial:

	Moisture. Per cent.	Ash. Per cent.	Protein. Per cent.	Crude fibre. Per cent.	N. free extract. Per cent.	Fat. Per cent.	IN WATER-FREE SUBSTANCE.	
							Total nitrogen. Per cent.	Albuminoid nitrogen. Per cent.
Alfalfa forage.....	75.3	2.0	3.7	6.6	11.8	1.1	2.41	1.90
Oat-and-pea forage....	67.4	1.9	4.4	7.6	17.4	1.3	2.18	1.72
Clover hay (mixed)....	12.0	4.9	8.5	28.9	43.4	2.3	1.55	1.38
Mixed grain, No. 39...	10.6	3.3	11.6	5.7	64.7	4.1	2.08	1.89

Table XII shows the results obtained in a feeding trial during July and August, 1894. Eight cows were used in this trial of the average age July 1 of 5.2 years. At that date they had been in milk on the average 37 months. From July 1 to 31 oat-and-pea forage was fed morning and noon, hay at night and a mixed grain, No. 39, consisting of five parts wheat bran, one part ground oats, five parts corn meal, one part wheat middlings. The grain represented 41.7 per cent. of the cost of the ration and supplied 21.0 per cent. of the digestible nutrients. The forage represented 37.0 per cent. of the total cost of the ration and supplied 65.0 per cent. of the total digestible nutrients. From August 1, to 9, inclusive, alfalfa forage was fed three times daily and mixed grain twice. The mixed grain, No. 40, was composed of four parts wheat bran, one part ground oats, eight parts corn meal, one part wheat middlings and one part "King" gluten meal. The grain cost 45.2 per cent. of the cost of the ration, the forage representing 54.8 per cent. The grain supplied 21.6 per cent. of the total digestible nutrients, the forage supplying 78.4 per cent.

From August 10 to 31, inclusive, corn silage was fed three times daily and mixed grain twice. The mixed grain, No. 41, was composed of six parts wheat bran, one part ground oats, two parts "King" gluten meal, and one part cotton-seed meal. The grain represented 41.2 per cent. of the total cost of the ration and the silage 58.8 per cent. The grain supplied 25.9 per cent. of the total digestible nutrients and the silage 74.1 per cent. Although the grain was changed for the second period and alfalfa forage took the place of oat-and-pea forage and hay — the food containing more moisture — there was almost no change in the proportion or amounts of the different constituents of the food. The nutritive ratio was the same and the fuel values nearly alike. The cost of the second ration was less. There was very little decrease in the milk yield, but a slight falling off in the per cent. of fat. The cost of milk was about the same and the cost of fat somewhat higher.

In the third period when corn silage was fed instead of alfalfa forage, the cost of the ration was increased, and the nutritive ratio was made considerably wider. There was an increase in the amount of fat and a decrease in the protein; the total nutritive substance was less and the fuel value lower. There was a

normal decrease in the milk yield and an increase in the per cent. of fat. There was considerable increase in the cost of milk and fat. There was an average gain in weight during July of 14 pounds and an average loss during August of 17.3 pounds. For the first period the greatest daily average milk yield was 40.2 pounds, and the least 16.4 pounds. The highest average per cent. of fat was 5.25 and the lowest 2.92 per cent. For the second period the extremes in daily average milk yield were 37.1 pounds and 17 pounds and in average percentage of fat 5.50 and 2.55. For the third period the extremes in milk yield were 37.2 pounds and 12.4 pounds and in average percentage of fat 5.55 and 2.57.

TABLE XII—A.

PERIOD.	AVERAGE PER DAY PER COW.							
	Average live weight per cow during period. Lbs.	Water. Lbs.	Corn silage. Lbs.	Alfalfa forage. Lbs.	Oat-and-pea forage. Lbs.	Mixed hay. Lbs.	Mixed grain. No. 38. Lbs.	Total dry matter in food. Lbs.
July 1 to 31 .....	993.5	89.48	.....	.....	51.85	5.94	5.96	63.75
August 1 to 9 .....	991.6	99.69	.....	71.52	.....	.....	No. 40. 5.85	77.37
August 10 to 31 .....	983.2	59.45	59.79	.....	.....	.....	No. 41. 5.89	65.68
								27.46
								28.34
								22.39

## B.

PERIOD.	AVERAGE PER DAY PER COW.							
	Moisture in food. Lbs.	Ash in food. Lbs.	Protein in food. Lbs.	Fats in food. Lbs.	Crude fibre in food. Lbs.	N. free extract in food. Lbs.	Total organic matter in ration. Lbs.	Total digestible nutrients. Lbs.
July 1 to 31 .....	36.29	1.48	3.47	1.05	6.00	15.56	25.98	18.57
August 1 to 9 .....	49.03	1.71	3.48	.99	7.81	14.85	26.63	18.64
August 10 to 31 .....	43.29	1.12	2.46	1.58	3.43	13.82	21.27	14.50
								Ratio of total protein to total carb hydrates in food. (Fats x $\frac{2}{3}$ .)
								1:6.9
								1:7.0
								1:8.5

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PERIOD.		PER 1,000 POUNDS LIVE WEIGHT FED.							
		Nutritive ratio.	Digestible proteids. Lbs.	Digestible fibre. Lbs.	Digestible N. free extract. Lbs.	Digestible fat. Lbs.	Total digestible nutrients. Lbs.	Total organic matter in ration. Lbs.	Calories of energy in ration. 'cal.
July	1 to 31 .....	1:7.1	2.45	4.26	11.25	.73	18.69	26.15	36486
August	1 to 9 .....	1:7.1	2.43	3.87	11.80	.70	18.80	26.86	36620
August	10 to 31 .....	1:9.2	1.61	2.20	9.63	1.31	14.75	21.63	30527

Di

PERIOD.	Per cent. ash in milk.	Per cent. fat in milk.	Per cent. casein and albumen in milk	Per cent. sugar in milk.	AVERAGE PER DAY PER COW.				Total solids in milk. Lbs.
					Ash in milk. Lbs.	Fat in milk Lbs.	Casein and albumen in milk. Lbs.	Sugar in milk. Lbs.	
July 1 to 31.....	.61	3.68	8.54	5.17	.17	1.02	.98	1.43	3.60
August 1 to 9.....	.63	3.44	8.68	5.02	.17	.93	1.00	1.36	3.46
August 10 to 31.....	.61	3.81	3.65	5.12	.16	.98	.94	1.32	3.40

## E.

PERIOD.	Total cost of food; average per day per cow. Cents.	Milk yield; average per day per cow. Lbs.	Pounds of water-free food consumed for one pound of milk produced. Lbs.	Pounds of water-free food consumed for one pound of milk solids produced. Lbs.	Pounds of water-free food consumed for one pound of fat produced. Lbs.	Cost of food for one pound of milk. Cents.	Cost of food for one pound of milk solids. Cents.	Cost of food for one pound of fat in milk. Cents.
July 1 to 31 .....	14.01	27.59	1.00	7.63	26.92	.51	3.89	13.74
August 1 to 9 .....	13.04	27.07	1.05	8.19	30.47	.48	3.77	14.03
August 10 to 31 .....	15.24	25.78	.87	6.59	22.85	.59	4.48	15.55

The composition of the oat-and-pea forage, of the hay and of the grain will be found on p. 241 and the composition of each of the other foods will be found in the following table:

	Moisture. Per cent.	Ash. Per cent.	Protein. Per cent.	Crude fibre. Per cent.	N. free extract. Per cent.	Fats. Per cent.	IN WATER-FREE SUBSTANCE.	
							Total nitrogen. Per cent.	Albuminoid nitrogen. Per cent.
Alfalfa .....	67.7	2.2	3.9	9.9	15.3	1.0	1.95	1.73
Corn silage .....	71.5	1.4	2.1	5.1	18.0	1.9	1.19	.74
Mixed grain, No. 40 .....	10.5	2.4	11.8	3.9	66.8	4.6	2.10	1.94
Mixed grain, No. 41 .....	9.2	4.7	20.3	6.5	51.9	7.4	3.57	3.34

In table XIII are given the data obtained in a feeding trial from September 1 to October 15, 1894. Seven cows were used which had been in milk on the average 4.1 months. The average age September 1 was 5.6 years. There was a change to corn forage from alfalfa and oat-and-pea forage and with the results from the two periods those obtained in a third, when only hay and grain were fed, are given for comparison. From September 1 to 15, inclusive, alfalfa forage was fed in the morning, oat-and-pea forage at noon and night, and a mixed grain (No. 40), composed of four parts wheat bran, one part ground oats, eight parts corn meal, one part wheat middlings and one part "King" gluten meal. The grain represented 45.8 per cent. of the cost of the ration, the forage representing 54.2 per cent. The grain supplied 22.9 per cent. of the total digestible nutrients, the forage supplying 77.1 per cent. From September 16 to 30, inclusive, corn forage was fed three times daily. The mixed grain fed (No. 42) was composed of five parts wheat bran, one part linseed meal, O. P., one part "King" gluten meal and one part cotton-seed meal. The grain represented 47.3 per cent. of the cost of the ration, the forage representing 52.7 per cent.; and the grain supplied 20.9 per cent. of the total digestible nutrients, the forage supplying 79.1 per cent. From October 1 to 15, timothy hay was fed three times daily, and the same mixed grain fed as during the preceding period. The grain represented 41.6 per cent. of the cost of the ration and supplied 31.5 per cent. of the total digestible nutrients.

In changing to the corn forage of the second period the nutritive ratio of the ration was made a little wider. There was somewhat less protein in the ration but almost the same amount of fat and of total nutrients, and there was not much difference in the fuel value; the cost of the ration was a little higher. There was but very little falling off in the milk yield and the per cent. of fat in the milk was slightly higher. The cost of milk was somewhat higher and also the cost of fat. In the third period, although more grain was fed, not enough hay was taken to prevent a falling off in the total dry matter consumed. Besides a decrease in the amount of protein—enough to make the ratio wider—there was a decrease in the amount of other constituents, and the fuel value of the ration was less. The cost of the ration

was much higher. There was considerable falling off in milk yield and only an ordinary change in the composition of the milk. There was an average gain in weight during each of the first two periods of nearly 12 pounds and a loss of about six pounds during the last period.

The greatest daily average milk yield for the first period was 27.5 pounds and the least 19.7 pounds. The highest average per cent. of fat was 5.35 and the lowest 2.30. The extremes for the second period in milk yield were 38.0 pounds and 19.4 pounds and in average percentage of fat 5.50 and 2.60. For the third period the extremes were 30.1 pounds and 15.0 pounds, and 5.90 per cent. and 2.25 per cent.

TABLE XIII—A.

PERIOD.	Average live weight per cow during period. Lbs.	AVERAGE PER DAY PER COW.						Total dry matter in food. Lbs.
		Water. Lbs.	Alfalfa forage. Lbs.	Oak and pea- forage. Lbs.	Mixed hay. Lbs.	Mixed grain. No. 40. Lbs.	Total food. Lbs.	
September 1 to 15 .....	963.9	74.00	22.25	43.84	.....	5.67	71.76	24.96
September 16 to 30 .....	975.5	51.10	.....	*70.31	.....	No. 40. 5.86	76.17	24.83
October 1 to 15 .....	978.3	81.87	.....	.....	19.29	6.40	25.69	22.74

\* Corn forage.

B.

PERIOD.	AVERAGE PER DAY PER COW.							
	Moisture in food. Lbs.	Ash in food. Lbs.	Protein in food. Lbs.	Fats in food. Lbs.	Crude fibre in food. Lbs.	N. free extract in food. Lbs.	Total organic matter in ration. Lbs.	Ratio of total protein to total carbohydrates in food. (Fat x 2 3/4).
September 1 to 15 .....	46.80	2.12	3.89	1.01	5.00	12.94	22.84	1: 5.2
September 16 to 30 .....	51.34	1.35	3.17	.99	3.69	15.62	23.48	1: 6.8
October 1 to 15 .....	2.95	1.12	2.37	.80	6.13	12.33	21.62	1: 8.6



E.

PERIOD.	Total cost of food; average per day per cow. Centa.	Milk yield; average per day per cow. Lbs.	Pounds of water-free food consumed for one pound of milk produced. Lbs.	Pounds of water-free food consumed for one pound of milk solids produced. Lbs.	Pounds of water-free food consumed for one pound of fat produced. Lbs.	Cost of food for one pound of milk. Centa.	Cost of food for one pound of milk solids. Centa.	Cost of food for one pound of fat in milk. Centa.
September 1 to 15....	12.25	26.56	.94	7.19	26.00	.46	3.53	12.76
September 16 to 30....	13.34	26.22	.95	7.11	25.08	.51	3.82	13.47
October 1 to 15....	16.53	20.66	1.10	8.15	28.07	.80	5.92	20.41

The composition of the mixed grain, No. 40, will be found on page 246, and that of each of the other foods is given in the following table:

	Moisture. Per cent.	Ash. Per cent.	Protein. Per cent.	Crude fibre. Per cent.	Nitrogen free extract. Per cent.	Fats Per cent.	IN WATER FREE SUBSTANCE.	
							Total nitrogen. Per cent.	Albuminoid nitrogen. Per cent.
Alfalfa forage.....	72.1	2.4	5.2	7.9	11.2	1.2	2.98	2.02
Oat and-pea forage....	68.8	3.3	4.7	6.9	15.2	1.1	2.39	1.88
Corn forage.....	72.1	1.5	2.5	4.7	18.3	.9	1.45	1.11
Mixed timothy hay....	11.6	4.1	4.3	29.6	48.3	2.1	.76	.69
Mixed grain, No. 42..	11.1	5.1	24.1	0.6	47.0	6.1	4.34	4.00

The results obtained in another trial with the same cows from October 1 to November 15, 1894, are given in table XIV. The cows had been in milk on the average a little over five months by October 1. The data for the first period of this trial have just been reported in the preceding large table, but are here repeated for comparison. In the second period alfalfa forage was fed in place of hay, and in the third period beets were fed. From October 16 to 31, inclusive, alfalfa forage was fed morning and noon and hay at night. The mixed grain, No. 43, consisted of five parts wheat bran, six parts corn meal, and one part each of wheat middlings, linseed meal, O. P., cotton-seed meal and gluten feed. The grain represented 44.6 per cent. of the total cost of the ration and supplied 30.6 per cent. of the total digestible nutrients. The forage represented 32.0 per cent. of the cost of the ration and supplied 47.9 per cent. of the nutrients. From November 1 to 15, inclusive, beets were fed morning and noon and hay at night. The mixed grain, No. 44, consisted of five parts wheat bran, one part ground oats, two parts corn meal, one part linseed meal, O. P., two parts "King" gluten meal, and one part cotton-seed meal. The grain represented 40.1 per cent. of the cost of the ration and supplied 33.1 per cent. of the total digestible nutrients. The beets represented 39.5 per cent. of the cost of the ration and supplied 43.6 per cent. of the total digestible nutrients.

The nutritive ratio of the second ration was considerably narrower than that of the first. There was an increase in the amount of protein and fat and of total nutrients. The fuel value was higher and the cost of the ration considerably less. There was a pronounced increase in the milk yield and not much change in the composition of the milk. The cost was much less for milk and fat than for the preceding period. In the third period the nutritive ratio was made wider, there was a decrease in the amount of digestible protein, fat, and of total nutrients — most noticeable in the fat. The cost of the ration was much higher and the fuel value was reduced to about that of the ration for the first period. There was a falling off in the milk yield from that of the second period, but very little more than the normal, accompanied by a slight decrease in the per cent. of fat. The milk and fat cost much more than in the second period.

TABLE XIV - A.

PERIOD.	AVERAGE PER DAY PER COW.						
	Average live weight per cow during period. Lbs.	Water. Lbs.	Beets. Lbs.	Alfalfa forage. Lbs.	Mixed hay. Lbs.	Mixed grain, No. 42. Lbs.	Total food. Lbs.
October 1 to 15.....	978.3	81.87	.....	.....	19.29	6.40	25.69
October 16 to 31.....	972.1	61.61	.....	46.62	6.80	No. 43. 6.40	58.92
November 1 to 15.....	968.0	41.18	45.59	.....	7.09	No. 44. 6.40	59.08
							18.40
							22.74
							22.68

## B.

PERIOD.	AVERAGE PER DAY PER COW.							
	Moisture in food. Lbs.	Ash in food. Lbs.	Protein in food. Lbs.	Fats in food. Lbs.	Crude fibre in food. Lbs.	N. free extract in food. Lbs.	Total organic matter in ration. Lbs.	Total digestible nutrients. Lbs.
October 1 to 15 .....	2.95	1.12	2.37	.80	6.13	12.33	21.62	12.67
October 16 to 31 .....	37.14	1.55	3.93	1.02	4.54	11.63	21.13	14.19
November 1 to 15 .....	40.68	1.27	2.51	.61	2.68	11.32	17.13	12.78
								1:8.6
								1:4.7
								1:6.1

U

PERIOD.	Nutritive ratio.	PER 1,000 POUNDS LIVE WEIGHT FED.						Calories of energy in ration. Cal.
		Digestible protein. Lbs.	Digestible fibre. Lbs.	Digestible N. free extract. Lbs.	Digestible fat. Lbs.	Total digestible nutrients. Lbs.	Total organic matter in ration. Lbs.	
October 1 to 15....	1:7.2	1.67	3.01	7.71	.57	12.96	22.09	25451
October 16 to 31....	1:4.6	2.79	2.32	8.74	.74	14.59	21.74	28884
November 1 to 15....	1:6.1	1.94	1.45	9.33	.49	13.20	17.70	25727

**D.**

PERIOD.	AVERAGE PER DAY PER COW.								
	Per cent. ash in milk.	Per cent. fat in milk	Per cent. casein and albumen in milk.	Per cent. sugar in milk.	Ash in milk. Lbs.	Fat in milk. Lbs.	Casein and albumen in milk. Lbs.	Sugar in milk. Lbs.	Total solids in milk. Lbs.
October 1 to 15.....	.62	3.94	3.77	5.18	.13	.81	.78	1.07	2.79
October 16 to 31.....	.63	3.91	3.90	4.95	.15	.90	.89	1.13	3.07
November 1 to 15.....	.65	3.81	3.97	5.23	.14	.82	.85	1.13	2.94

## E.

PERIOD.	Total cost of food; average per day per cow. Cents.	Milk yield; average p-r day per cow. Lbs.	Pounds of water-free food consumed for one pound of milk produced. Lbs.	Pounds of water-free food consumed for one p and one pound of milk-solids produced. Lbs.	Pounds of water-free food consumed for one pound of fat produced. Lbs.	Cost of food for one pound of milk. Cents.	Cost of food for one pound of milk-solids. Cents.	Cost of food for one pound of fat in milk. Cents.
October 1 to 15.....	16.53	20.66	1.10	8.15	28.07	.80	5.92	20.41
October 16 to 31....	14.56	22.91	.99	7.39	25.20	.64	4.74	16.18
November 1 to 15.....	17.33	21.53	.85	6.29	22.44	.80	5.89	21.13

There was an average loss in weight during October of about 12 pounds and during the third period of about two pounds. The greatest daily average milk yield for the second period was 32.6 pounds and the least 17.1 pounds. The highest average per cent. of fat was 5.60 and the lowest, 2.70. For the last period the extremes in daily average milk yield were 30.9 pounds and 15.6 pounds, and in percentage of fat 6.00 and 2.60. The composition of the hay and of the mixed grain, No. 42, fed during the first period, will be found on page 251. The following table shows the composition of each of the other foods :

	Moisture. Per cent.	Ash. Per cent.	Protein. Per cent.	Crude fibre. Per cent.	Nitrogen free extract. Per cent.	Fats. Per cent.	IN WATER-FREE SUBSTANCE.	
							Total nitrogen. Per cent.	Albuminoid nitrogen. Per cent.
Alfalfa forage.....	74.5	2.3	5.5	4.8	9.7	1.2	3.73	2.94
Beets .....	85.4	1.5	1.4	.8	10.8	.1	1.49	.75
Hay (Nov. 1 to 15)....	14.4	4.9	7.2	28.8	42.6	2.1	1.35	1.24
Mixed grain, No. 43....	10.8	3.2	16.9	4.2	50.9	5.0	3.02	2.94
Mixed grain, No. 44....	11.4	3.7	21.3	4.4	52.8	6.4	3.84	3.63

## General Observations.

These feeding trials here reported, though many of them for periods necessarily rather short, were repeated for several seasons and are the average results from a number of different cows, so that the indications which they all give of the value of alfalfa can hardly be considered accidental.

The average of all the analyses made of the fourteen lots of alfalfa used in these feeding trials will give an idea of the general composition of alfalfa forage. The average composition of three lots of mature corn forage might be considered beside that of the alfalfa for comparison as follows:

	Alfalfa forage.	Corn forage.
Per cent. of moisture.....	75.10	71.80
“ of ash .....	2.28	1.20
“ of protein.....	4.48	2.27
“ of true albuminoids .....	3.53	1.97
“ of crude fibre.....	6.59	5.17
“ of N. free extract.....	10.26	18.46
“ of fats.....	1.29	1.10

In determining the cost of milk, for purpose of comparison, for each period reported in the preceding tables, the cost of the food only was considered. The manurial values of the foods were not taken into account, although under favorable conditions the net cost to the farm of milk would be much influenced by the fertilizing values of the foods. The manurial values of rations containing alfalfa and of those containing highly nitrogenous grain foods would be much greater than of most rations, but except where special attention is given to careful handling of manure, only a small proportion of the possible amount would be recovered.

When alfalfa forage was substituted for some other food or the amount of alfalfa in the ration increased, there followed in 10 instances a decrease in the cost of the milk, in two instances a very slight increase in cost, and in two instances the cost of milk was practically the same. There was an increase in the yield of milk in seven instances, a decrease in four instances of about what might normally be expected to occur without change of food, and little change in yield in three instances.

When the change was from a ration containing alfalfa to one containing less or no alfalfa, there followed an increase in the cost of milk in 10 instances and there was about the same cost once. There was a decrease of the milk yield in nine instances, and an increase of the milk yield in two.

When alfalfa was substituted for other foods in the ration or the amount of alfalfa increased, there followed a decrease in the cost of fat in seven instances and an increase of the cost in six instances. There was an increase of the amount of fat in six instances, a decrease in five instances and little change in amount twice.

When the change was from a ration containing alfalfa to one containing less or none, there followed an increase in the cost of fat in nine instances, a decrease in cost once, and there was about the same cost twice. There was an increase of the amount of fat in three instances, a decrease in three, and about the same amount of fat in five.

When the change in the ration was to more alfalfa, or to alfalfa in place of some other food, there followed a decrease in per cent. of fat in milk in six instances, an increase in three, and little change in per cent. in four instances. When changed from a ration containing alfalfa to one containing less or none, there followed an increase in per cent. of fat in six instances and a decrease of per cent. in five.

There has been usually an increase in milk yield accompanying the use of alfalfa, although there was often at the same time a decrease in the per cent. of fat. With alfalfa forage rated at the same cost as other forage, there was generally a decrease in the cost of milk when the alfalfa was fed and not much change in the cost of the fat produced.

Corn forage (fully matured) in the results accompanying its use has compared most favorably with alfalfa; but except in the form of silage it is only available for a short time in the fall before frost. Alfalfa is ready for the first cutting about the time for planting the corn and about as early as rye forage can be cut. The proportions of constituents also differ so widely between alfalfa and corn forage that these plants can not well be considered as substitutes for each other, but as supplementary. For making rations like those usually fed, coarse fodder and

grain foods, in general cheaper than those used with corn forage, can be fed with alfalfa. The more highly nitrogenous grains and hays fed with corn forage or silage, however, have a much higher manurial value, which fact is often of wide importance.

The palatability of alfalfa or of corn (maize) is greater than of most other forage plants of rapid growth that will yield heavy crops. This is a matter of the greatest importance, for while the milk may temporarily be produced at the expense of loss in weight of the animal, the flow of milk must be sustained by the food taken in excess of that necessary for maintenance.

Any discussion of the general fluctuations of milk yield as influenced by the proportions of the different constituents of the food, and by the nutritive ratio of the ration, is reserved until some data from winter rations fed for longer periods shall be published.

#### REMARKS CONCERNING THE CULTIVATION OF ALFALFA.

For those who are unacquainted with alfalfa a few general facts concerning the plant may be briefly mentioned here to advantage. Alfalfa (*Medicago sativa*), sometimes called lucerne, although not generally known in this part of the country, has been in cultivation for a long time. It was cultivated by the Egyptians, Greeks and Romans, and in later centuries by the nations of the warmer parts of Europe. It was early introduced into South America and brought from there to Mexico and California.

Alfalfa being a leguminous plant like the clovers and able to gather nitrogen that is not available to most plants, will, when the crop is fed on the farm, enrich the soil in this necessary element and leave a field in improved condition when finally plowed under. The long tap root with its numerous branches reaches deep in the sub-soil (roots often reach to a depth of 10 or 12 feet—are said sometimes to extend over 20 feet) and is often able to obtain plant food and water for the lack of which surface feeding plants may be suffering. The plant is a perennial and when once well established will yield paying crops for an indefinite number of years if the field is not overrun with grass or plantain.

Alfalfa grows well on widely varying kinds of top soil, but the subsoil must be open and porous. It does best on a warm and

friable soil with a loose or gravelly subsoil. A dense clay or hardpan subsoil is most unfavorable. Although a rich soil is of course the best and gives the largest crops, alfalfa sometimes does exceedingly well on poor gravelly soils. The plant consumes much water but will not survive long in a saturated or flooded soil, and too much water in the soil during winter is fatal. If water stands for any considerable time within a few feet of the surface the crop will be injured. Alfalfa, in the west, seldom if ever winter kills on ground with a deep and porous subsoil.

The seed should not be sown except the soil has received careful and thorough preparation, for it is of the utmost importance to secure a dense and uniform stand, especially if hay is to be made. If crops of seed only are desired a more scattering stand of plants may give good results. The seed should be sown in the spring, after danger of severe frost is past, and when the ground would be considered in the best possible condition for planting garden seeds. The treatment of the soil for the preceding season should have been such as to have most effectually subdued all weeds, and caused the sprouting and destruction of any seeds in the ground. The seed should not be sown with grain, but alone; although a good catch is sometimes reported when sown with oats—only about half the usual quantity of grain being used. If sown with grain the young plants are likely to be killed by the sun after the grain is cut. It is best to sow not less than 30 pounds of seed per acre—especially when sown broadcast. When sown with the drill 20 pounds often give good results. In short, to guard against the decidedly unsatisfactory result of a poor stand, plenty of seed should be used on carefully prepared ground.

Pure seed is essential. Only plump, bright, good seed should be sown, for shrunken seed may produce weak and worthless plants. The seed resembles that of red clover, but is larger. Too many small seeds would indicate the possible admixture of white clover, etc. The presence of the seed of narrow-leaf-plantain or rib-grass, it is of vital importance to guard against. This is a long brownish seed, something like a diminutive date seed, and is easily detected without the aid of a glass by anyone familiar with it.

In order to check the growth of weeds, a mowing machine can be run over the field of young alfalfa with the cutting bar raised

so as to avoid cutting near the crowns of the young plants. If the clipping is not too heavy it can, with advantage, be left on the field, and will serve as a mulch during the dry weather. On rich soil sometimes two crops can be secured the first year, but on poor soil or in a dry season no crop can be expected the first year. Alfalfa should be cut every time it begins to blossom, whether the growth is short or tall, unless a seed crop is desired. The second crop of the season is better for seed than the first, possibly on account of the greater number of insects that assist in fertilizing the blossoms.

Alfalfa is of exceptional value as a soiling crop, but it will also make excellent hay, palatable and very nutritious. Much care and time are necessary to make good hay, and experience and good judgment are required. If handled much when very dry, all the leaves are likely to fall off, and if not thoroughly cured it is likely to mold and mildew. The hay will not shed water well and any stacks should be well covered.

If you have a suitable field, try a small patch of alfalfa — not too much at first.

Some results from feeding trials with silage and other foods used in winter rations are not yet prepared for publication, but will be so soon as pressure of other work will permit.

It is intended that the results obtained in a feeding experiment with laying hens shall be published in bulletin form so soon as they are arranged in suitable shape for publication.

Data from a number of feeding trials made during the year with pigs are not yet in form to be given at the time of this report.

## REPORT OF THE CHEMIST.\*

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The following statement indicates in outline the various subjects considered in this report :

- I. Summary of laboratory work.
- II. Arrangement of chemical work.
- III. Bulletins and addresses.
- IV. Character and extent of investigation relating to different breeds of dairy cows.
- V. Comparison of different breeds of dairy cows with reference to the production of milk.
- VI. Comparison of different breeds of dairy cows with reference to the production of cream and butter.
- VII. Comparison of different breeds of dairy cows with reference to the production of cheese.
- VIII. Tabulated data pertaining to comparison of different breeds of dairy cows.
- IX. Character and extent of investigation made relating to the manufacture of cheese during the season of 1894.
- X. Summary of results relating to conditions of manufacture of cheese.
- XI. A study of the composition of milk.
- XII. A study of the composition of whey.
- XIII. A study of the composition of cheese.
- XIV. Loss of milk-constituents in cheese-making.
- XV. Relation of composition of milk to yield of cheese.
- XVI. The loss of weight in cheese.
- XVII. General summary of the results of cheese investigation.

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\* L. L. Van Slyke, A. M., Ph. D.

XVIII. The determination of albumen in cows' milk.

XIX. Trade values of fertilizing materials for 1894.

XX. Analyses of commercial fertilizers collected in the spring of 1894.

XXI. Analyses of commercial fertilizers collected in the fall of 1894.

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## I. SUMMARY OF LABORATORY WORK.

The following table shows, in a brief form, the extent and character of chemical work done during the past year :

TABULATED STATEMENT OF LABORATORY WORK FOR THE YEAR 1894.

	In milk.	In skim-milk.	In cheese.	In whey.	In foods.	In fertilizers.	In soils.	In casein.	In albumen.	In dung.	In syrup.	Totals.
Determinations of nitrogen.....	1,807	.....	435	190	247	845	6	2,078	1,952	..	....	7,560
Determinations of fat (Babcock test).....	1,657	10	.....	.....	.....	.....	.....	.....	.....	.....	.....	1,667
Determinations of fat (ether extract).....	231	.....	210	132	240	.....	.....	.....	.....	60	.....	873
Determinations of water.....	1,807	.....	210	132	113	10	.....	27	.....	.....	.....	2,299
Determinations of ash.....	1,446	.....	2	51	180	.....	.....	124	.....	.....	.....	1,803
Determinations of crude fibre.....	.....	.....	.....	.....	116	.....	.....	.....	.....	.....	.....	116
Determinations of starch and sugar.	7	.....	.....	.....	350	.....	.....	.....	.....	.....	13	370
Determinations of phosphoric acid.	.....	.....	.....	.....	69	2,899	2	.....	.....	.....	.....	2,970
Determinations of potash.....	.....	.....	.....	.....	38	841	.....	.....	.....	.....	.....	879
Determinations of acidity.....	165	.....	.....	67	136	.....	.....	118	.....	.....	.....	486
Microscopical examinations.....	521	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	521
Solids by lactometer.....	516	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	516
Separations of casein.....	2,252	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	2,252
Separations of albumen.....	2,059	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	2,059
Grand total.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	24,371

## II. ARRANGEMENT OF CHEMICAL WORK.

The chemist gives such general and special supervision to all the different lines of work as they may require. The work done in the way of preparing bulletins and giving addresses is given below under a special head.

The present arrangement of chemical work among the assistant chemists is as follows :

Mr. C. G. Jenter has special charge of the analysis of butter, of cattle foods and similar materials, of the determination of copper in plants, soils, etc., of miscellaneous analytical work, and of photographic work.

Mr. A. L. Knisely has special charge of the analysis of milk, whey and cheese, and of the microscopical examinations of milk. He has also done considerable work in relation to methods of separating and determining the different classes of nitrogen compounds in milk, whey and cheese.

Mr. W. B. Cady has special charge of all nitrogen determinations and also assists in analysis of dairy products.

Messrs. A. D. Cook and H. H. Seely give their entire time to the analysis of commercial fertilizers and fertilizing materials.

Mr. John Collins is laboratory assistant, attending to various kinds of routine mechanical work. Mr. Collins also has charge of the determination of fat in milk, skim-milk, etc., by the Babcock test.

Mr. A. H. Horton has charge of keeping the records connected with the investigation of dairy breeds of cattle, which require numerous and extended calculations.

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## III. BULLETINS AND ADDRESSES.

During the year the chemist has prepared the following station bulletins, 10 in number, aggregating 415 pages:

Bulletin No. 65 — New Series — January, 1894 (134 pages). Investigation relating to the manufacture of cheese.

Bulletin No. 66 — New Series — January, 1894 (23 pages). Analyses of commercial fertilizers collected in the fall of 1893.

Bulletin No. 68 — New Series — March, 1894 (44 pages). Fat in milk as a practical basis for determining the value of milk for cheese-making.

Bulletin No. 70 — New Series — April, 1894 (17 pages). Some reasons why the legal milk standard of New York State should be changed.

Bulletin No. 70 — New Series — May, 1894 (20 pages). Some reasons why there should be a legal standard for cheese in New York State.

Bulletin No. 73 — New Series — July, 1894 (33 pages). Analyses of commercial fertilizers collected during the spring of 1894.

Bulletin No. 77 — New Series — November, 1894 (30 pages). Comparison of different breeds of dairy cows with reference to the cost of milk production.

Bulletin No. 78 — New Series — November, 1894 (30 pages). Comparison of different breeds of dairy cows with reference to the cost of butter and cream production.

Bulletin No. 79 — New Series — November, 1894 (22 pages). Comparison of different breeds of dairy cows with reference to the cost of cheese production.

Bulletin No. 82 — New Series — December, 1894 (62 pages). Results of investigation relating to the manufacture of cheese for the season of 1894.

During the year the chemist has given the following addresses :

“The Relation of Milk Fat to Cheese Yield,” in January, 1894, before the Western Ontario Dairymen’s Association, at Ingersoll, Ont., Canada.

“Fat in Milk as a Practical Basis in Paying for Milk at Cheese Factories,” at the following Farmers’ Institutes: Gouverneur, St. Lawrence county; Vernon and Boonville, Oneida county; Attica and Pike, Wyoming county; Holland, Erie county; Gowanda, Cattaraugus county; Ithaca, Tompkins county; Oswego, Oswego county.

“Purchase and Use of Fertilizers,” at Pittsford, Monroe county; Mt. Kisco, Westchester county; Riverhead, Suffolk county, and Mineola, Queens county.

“Comparison of Profits Derived from Production of Milk, Cream, Butter and Cheese,” at Auburn.

“What Science Has Done for Dairying,” at the State Fair in Syracuse in September, 1894.

“What Has Science Done for Farmers?” at Utica and Batavia before Pomona Grange meetings.

"Some of the Solved and Unsolved Problems of Dairying," at Oneonta, in December, 1894, before the annual convention of the New York Dairymen's Association.

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#### IV. CHARACTER AND EXTENT OF INVESTIGATION RELATING TO DIFFERENT BREEDS OF DAIRY COWS.

In undertaking this investigation relating to the different breeds of dairy cattle, it was the original purpose to publish the results at regular intervals; but it has been found impracticable to carry out the original plan, since it has been found impossible to control all the conditions of experiment as completely as was at first expected. While the original plan contemplated work with four individuals of each breed, it is our hope that we may continue the investigation until we have worked with a much larger number of each breed. As our data accumulate they will become more valuable and will yield more definite and reliable results in respect to many questions which are now among the unsolved dairy problems.

A few of the animals, whose records have appeared in previous reports, have died, while a few have been found to be in condition more or less abnormal and unfitted for further investigation as representative animals of their respective breeds; and, in place of these animals, young heifers have been substituted. There has been an occasional abortion, which has caused us to omit the publication of the results of that period of lactation. Owing to all the different causes which are not unfamiliar in regular dairy experience, the investigation has not progressed as rapidly as was at first anticipated. However, it will be seen that good progress has been made, all things considered, and the data already on hand emphasize the increasing value and importance of the investigation. Before taking up a presentation and discussion of our results, we will consider some points that need preliminary explanation.

In this report on the cost of milk production we shall present and discuss the following topics:

1. Unit of time adopted for comparison.
2. Tabulated statement giving ages and dates of calving of different cows.

3. Prices of foods used.
4. Cost of food eaten.
5. Amount of milk produced.
6. Food-cost of one quart and one pound of milk.
7. Amount of milk-solids produced.
8. Per cent. of solids in milk.
9. Cost of one pound of milk solids.
10. Money value of milk produced.
11. Profit derived from selling milk.
12. Production of milk for manufacture of condensed milk.
13. General summary.

#### 1. UNIT OF TIME ADOPTED FOR COMPARISON.

Any comparison of individuals or breeds, based upon a few weeks or even months, must necessarily be incomplete, imperfect and more or less misleading, because our work has shown that the influence of the advance of lactation is very marked upon the character and yield of milk. We have, therefore, adopted as our unit of comparison a period of lactation, and have farther defined a period of lactation in this investigation, to consist of the first ten months of lactation. Work here and elsewhere fully justifies us in fixing upon this arbitrary limit. While some animals are more persistent than others in their milk production, this quality of persistence is an individual peculiarity rather than a breed characteristic, so far as we can yet learn; and, moreover, this quality is dependent upon several conditions and is, to some extent, under the control of the dairyman. Some of our animals have, in one period of lactation, continued their profitable milk production considerably beyond 10 months, and the same animals, in the succeeding period of lactation, have ceased to produce milk soon after or even before the expiration of 10 months. Taking the practice of our best dairymen and our own experience, we find that 10 months represent very closely the average duration of one period of lactation.

2. TABLE SHOWING AGES AND DATES OF CALVING OF DIFFERENT COWS.

NAME OF COW.	When born.	Age at first calving.	Age at second calving.	Age at third calving.	Age at fourth calving.
<i>American Holderness.</i>					
Maggie 6th.....	Aug. 15, 1888	2 yrs. 1 mo. 4 days	3 yrs. 9 mos. 2 days...	4 yrs 8 mos. 28 days...	.....
Nora.....	Sept. 25, 1890	3 yrs. 2 mos. 28 days	.....	.....	.....
<i>Ayrshire.</i>					
Junketta Peerless.....	July 26, 1888	2 yrs. 6 mos. 13 days	3 yrs. 9 mos. 5 days	4 yrs. 9 mos. 10 days	.....
Manton Belle.....	June 16, 1888	2 yrs. 6 mos.	3 yrs. 6 mos. 13 days	4 yrs. 6 mos. 5 days	5 yrs. 5 mos. 26 days.
Miss Flow 5th.....	March 1, 1888	1 yr. 11 mos. 11 days	2 yrs. 11 mos. 17 days	4 yrs. 2 mos. 5 days	5 yrs. 1 mo. 19 days.
Queen Duchess.....	Feb. 21, 1888	2 yrs. 5 mos. 4 days	3 yrs. 9 mos. 3 days	.....	.....
<i>Devon.</i>					
Artalia.....	Jan. 12, 1889	2 yrs 11 mos. 12 days	.....	.....	.....
Genevieve's Gift.....	Sept. 10, 1889	1 yr. 8 mos.	3 yrs. 1 mo. 11 days	.....	.....
Ione.....	March 5, 1893	3 yrs. 2 days	4 yrs. 3 mos. 25 days	.....	.....
<i>Guernsey.</i>					
Madam Select.....	March 2, 1889	.....	3 yrs. 7 mos. 10 days	.....	.....
Ortolo.....	Aug. 25, 1888	2 yrs. 3 mos. 14 days	4 yrs. 3 mos. 13 days	.....	.....
Rosette Ford.....	May 10, 1888	3 yrs. 6 mos. 8 days	4 yrs. 8 mos. 30 days	.....	.....
Stella Select.....	Dec. 8, 1889	.....	.....	.....	.....
<i>Holstein-Friesian.</i>					
Beauty Pledge.....	March 10, 1890	.....	3 yrs. 8 mos. 30 days	.....	.....
Beal 2nd.....	June 22, 1888	2 yrs. 34 days	.....	.....	.....
Netherland Constance.....	July 27, 1891	2 yrs. 2 mos. 26 days	3 yrs 2 mos. 26 days	.....	.....
Euth.....	May 23, 1891	2 yrs. 5 mos. 11 days	.....	.....	.....
<i>Jersey.</i>					
Albert's Carol.....	Jan. 12, 1890	3 yrs. 2 mos. 14 days	3 yrs 9 mos. 19 days	.....	.....
Barbara Allen.....	Aug. 12, 1888	2 yrs. 11 days	3 yrs. 8 mos. 23 days	4 yrs 8 mos. 16 days	.....
Constance Flavia.....	May 14, 1888	2 yr. 11 mos. 10 days	3 yrs. 6 mos.	4 yrs. 6 mos.	5 yrs. 6 mos. 20 days.
Gliderboom.....	April 6, 1888	2 yrs. 5 mos 6 days	3 yrs. 10 mos. 23 days	5 yrs. 7 days	.....
<i>Shorthorn.</i>					
Betsey 10th.....	Nov. 18, 1889	2 yrs. 5 mos. 17 days	4 yrs. 17 days	.....	.....

The above table shows that we have the full records of 22 different animals for from one to four periods of lactation each, divided among the different heads as follows :

NAME OF BREED.	Number complet- ing one period of lactation.	Number complet- ing two periods of lactation.	Number complet- ing three periods of lactation.	Number complet- ing four periods of lactation.	Total number of periods of lacta- tion.
American Holderness.....	1	.....	1	.....	4
Ayrshire.....	.....	1	1	2	13
Devon.....	1	2	.....	.....	5
Guernsey.....	2	2	.....	.....	6
Holstein-Friesian.....	3	1	.....	.....	4
Jersey.....	.....	1	2	1	12
Shorthorn.....	.....	1	.....	.....	.....

### 3. PRICES OF DIFFERENT FOODS USED.

The composition of the foods and of the various rations fed to the cows are fully given in the ninth and succeeding annual reports of this Station. In fixing prices for the food materials purchased, we have taken the actual market values at which they were purchased in 1889-1891, when they were first bought. The prices were at that time, in several cases, above the average market value, but, in order that our data may be comparable from year to year, it is necessary that, throughout the investigation, we adhere to a fixed scale of prices. Any prices that might be given must be local and temporary; and, if anyone desires to know the absolute cost of food, it can be readily calculated by comparing the prices given in the table below with those actually found at any particular time or place. The values assigned to the food materials produced on our farm are likewise variable for different localities, and we have fixed such values as seemed fair in our judgment. The values fixed for one ton of the different foods used in this investigation are as follows:

Alfalfa hay.....	\$12 00
Clover hay.....	12 00
Corn ensilage.....	3 00
Corn stalks (cured).....	5 00

Green forage (alfalfa, corn stalks, oats and peas, etc.)....	\$2 00
Mixed-grass hay .....	10 00
Roots (turnips, beets, etc.).....	3 00
Corn meal.....	20 00
Cotton seed meal.....	29 60
Gluten feed .....	18 00
Gluten meal .....	27 00
Ground flaxseed .....	60 00
Ground oats .....	25 00
Linseed meal, new process .....	20 00
Linseed meal, old process .....	26 50
Wheat bran .....	20 00
Wheat middlings .....	20 00

#### EXPLANATION OF TABLES.

The methods of comparison of results must, of necessity, be more or less largely tabular. Under each head, so far as practicable, we shall present three tables, A, B and C.

Table A will contain data pertaining to each individual cow for each period of lactation completed and will, therefore, constitute the basis of a comparison of individuals and of breeds.

Table B will contain the same data averaged for all the cows of each separate breed for the different periods of lactation; in other words, the data will represent a comparison of breeds and not of individuals.

Table C will contain the average results by breeds for all periods of lactation, arranged in order, commencing with the lowest; and, also, a modified arrangement, showing the comparative results based on 100 as representing the lowest. This will show a comparison of both actual and relative values. Each table will also show the number of cows of each breed represented by the results, and, in addition, the aggregate number of lactation periods completed by those cows.

#### PRECAUTIONS TO BE OBSERVED IN STUDYING RESULTS.

The method of comparison used would be open to criticism, if the data were put forward as representing final results. We desire to emphasize the statement that these results are liable to greater or less modification. Final judgment can be rendered

only when we have secured life records of a number of animals of each breed sufficient to overcome the variations of individuals and give us what may fairly represent the average of the breed.

So far as we have gone, the results indicate generally that the larger the number of lactation periods recorded, the greater the results secured. Hence, to compare the first lactation period of one breed or animal will not indicate the same relation that a comparison of the same number of lactation periods would. It will, therefore, be well to keep in mind that the animals and breeds having the fewer number of lactation periods completed will probably improve in the future more than those that have completed a larger number of periods.

## V. COMPARISON OF DIFFERENT BREEDS OF DAIRY CATTLE WITH REFERENCE TO THE PRODUCTION OF MILK.

### 1. COST OF FOOD EATEN.

For the sake of uniformity in making our comparisons of the breeds, we have arbitrarily adopted ten months as the duration of a single period of lactation. In actual dairying, if a cow were productive ten months in each year, and non-productive during two months, the cost of keeping her twelve months would need to be considered in order to find the actual cost of keeping and production. The actual cost would be based, not upon the cost of her food for the ten productive months, but upon the cost of her food for the whole year, the non-productive as well as the productive period. However, in this investigation, we are not so much concerned with actual cost as with relative cost of production. Therefore, calculating for all breeds alike, the cost of production from the food consumed during the same productive period, we secure values that show the true *relative* cost of production for the different breeds.

The table immediately below gives the cost of food eaten by each animal for each period of lactation :

TABLE A — SHOWING COST OF FOOD EATEN BY COWS.

Breed.	NAME OF COW.	PERIOD OF LACTATION			
		First.	Second.	Third.	Fourth
American Holderness.....	Maggie 6th.....	\$38 90	\$47 20	\$47 70	.....
American Holderness.....	Nora.....	37 78	.....	.....	.....
Ayrshire.....	Junietta Peerless.....	.....	50 90	52 40	.....
Ayrshire.....	Manton Belle.....	42 30	50 90	58 40	\$47 82
Ayrshire.....	Miss Flow 5th.....	48 50	40 40	50 80	51 60
Ayrshire.....	Queen Duchess.....	49 00	49 30	.....	.....
Devon.....	Artalia.....	41 80	.....	.....	.....
Devon.....	Genevieve's Gift.....	28 70	38 70	.....	.....
Devon.....	Ione.....	36 40	42 00	.....	.....
Guernsey.....	Madame Select.....	.....	47 40	.....	.....
Guernsey.....	Oriole.....	38 20	48 00	.....	.....
Guernsey.....	Rosetta Ford.....	40 90	55 00	.....	.....
Guernsey.....	Stella Select.....	47 40	.....	.....	.....
Holstein-Friesian.....	Beauty Pledge.....	.....	49 55	.....	.....
Holstein-Friesian.....	Esel 2d.....	52 70	.....	.....	.....
Holstein-Friesian.....	Netherland Constance.....	57 50	.....	.....	.....
Holstein-Friesian.....	Ruth.....	43 17	.....	.....	.....
Jersey.....	Albert's Carol.....	46 30	42 61	.....	.....
Jersey.....	Barbara Allen.....	44 10	48 20	50 20	.....
Jersey.....	Countess Flavia.....	50 00	45 10	48 90	45 07
Jersey.....	Gilderbloom.....	41 70	.....	48 80	.....
Shorthorn.....	Betsy 10th.....	44 00	48 45	.....	.....

TABLE B — SHOWING AVERAGE COST PER COW OF FOOD EATEN BY DIFFERENT BREEDS.

BREED.	FIRST PERIOD OF LACTATION.		SECOND PERIOD OF LACTATION.		THIRD PERIOD OF LACTATION.		FOURTH PERIOD OF LACTATION.		Average of all periods of lactation.
	Number of cows.	Cost of food.	Number of cows.	Cost of food.	Number of cows.	Cost of food.	Number of cows.	Cost of food.	
American Holderness .....	2	\$38 34	1	\$47 20	1	\$47 70	....	.....	\$12 90
Ayrshire .....	3	46 60	4	47 87	3	53 70	2	\$49 71	49 32
Devon .....	3	35 63	2	40 35	....	.....	....	.....	37 52
Guernsey .....	3	42 17	3	50 13	....	.....	....	.....	46 15
Holstein-Friesian ..	3	51 12	1	49 55	....	.....	....	.....	50 73
Jersey .....	4	45 50	3	45 30	3	45 80	1	45 07	45 49
Shorthorn .....	1	44 00	1	48 45	....	.....	....	.....	46 22

TABLE C—SHOWING SUMMARY OF COST OF FOOD EATEN.

BREED.	Number of cows	Total number of periods of lactation.	Actual average cost per cow for all periods of lactation.	Relative cost of food eaten.
Devon .....	3	5	\$37 52	100
American Holderness .....	2	4	42 90	114
Jersey .....	4	11	45 49	121
Guernsey .....	4	6	46 15	123
Shorthorn .....	1	2	46 22	123
Ayrshire .....	4	12	49 32	131
Holstein-Friesian .....	4	4	50 73	135

## 2. AMOUNT OF MILK PRODUCED.

The relative cost of food eaten by the different animals of the different breeds is a matter of interest and importance, but, taken by itself, it is valueless information, so far as it enables us to form an accurate idea of the relative cost of the product and economy of production in the case of these cows and breeds.

We will, therefore, consider the amount of milk produced, the cost of one pound and of one quart of milk, the amount of milk-solids produced and the cost of one pound of milk-solids.

TABLE A—SHOWING POUNDS OF MILK PRODUCED BY COWS.

Breed.	NAME OF COW.	PERIOD OF LACTATION.			
		First.	Second.	Third.	Fourth.
		Pounds.	Pounds.	Pounds.	Pounds.
American Holderness	Maggie 6th	4703	6113	5903	
American Holderness	Nora	6164			
Ayrshire	Junietta Peerless		7298	8880	
Ayrshire	Manton Belle	6296	6314	8188	7725
Ayrshire	Miss Flow 5th	5133	5116	6507	6085
Ayrshire	Queen Duchess	6991	7299		
Devon	Artalia	5014			
Devon	Genevieve's Gift	3049	4007		
Devon	Ione	3944	3904		
Guernsey	Madame Select.		4770		
Guernsey	Oriole	5203	6016		
Guernsey	Rosette Ford	4866	6113		
Guernsey	Stella Select	6353			
Holstein-Friesian	Beauity Pledge		8550		
Holstein-Friesian	Eael 2d	7315			
Holstein-Friesian	Netherland Constance	9458			
Holstein-Friesian	Ruth	6388			
Jersey	Albert's Carol	4724	4886		
Jersey	Barbara Allen	4616	5175	6416	
Jersey	Countess Flavia	5125	5018	4638	5715
Jersey	Gilderbloom	4000		5844	
Shorthorn	Betsey 10th	5019	7091		

TABLE B — SHOWING AVERAGE AMOUNT OF MILK PRODUCED PER COW.

BREED.	FIRST PERIOD OF LACTATION.		SECOND PERIOD OF LACTATION.		THIRD PERIOD OF LACTATION.		FOURTH PERIOD OF LACTATION.		Average of all periods of lactation.
	Number of cows.	Pounds of milk.	Number of cows.	Pounds of milk.	Number of cows.	Pounds of milk.	Number of cows.	Pounds of milk.	
American Holderness .....	2	5433	1	6113	1	5903	....	.....	5721
Ayrshire .....	3	6140	4	6507	3	7843	2	6905	6824
Devon .....	3	4002	2	3956	....	.....	....	.....	3984
Guernsey .....	3	5134	3	5633	....	.....	....	.....	5385
Holstein-Friesian .....	3	7704	1	8560	...	.....	....	.....	7918
Jersey .....	4	4616	3	4860	3	5583	1	5715	5045
Shorthorn .....	1	5019	1	7091	....	.....	....	.....	6055

TABLE C—SHOWING SUMMARY OF AMOUNT OF MILK GIVEN.

BREED.	Number of cows.	Total number of periods of lactation.	Actual average yield of milk per cow for all periods of lactation.	Relative yield of milk.
			Pounds	
Devon.....	3	5	3984	100
Jersey .....	4	11	5045	127
Guernsey .....	4	6	5385	135
American Holderness .....	2	4	5721	144
Shorthorn .....	1	2	6055	152
Ayrshire .....	4	12	6824	172
Holstein-Friesian .....	4	4	7918	199

## 3. FOOD-COST OF ONE QUART AND OF ONE POUND OF MILK.

In calculating the cost of production of milk, we include only the cost of the food eaten by the cows. One quart of milk is estimated to weigh 2.15 pounds on an average.

TABLE A—SHOWING COST OF MILK PRODUCED BY COWS.

Breed.	NAME OF COW.	PERIOD OF LACTATION.							
		FIRST.		SECOND.		THIRD.		FOURTH.	
		Cents per quart.	Cents per pound.	Cents per quart.	Cents per pound.	Cents per quart.	Cents per pound.	Cents per quart.	Cents per pound.
American Holderness.	Maggie 6th.	1.78	0.88	1.66	0.77	1.74	0.81	.....	.....
American Holderness.	Nora.	1.82	0.81	.....	.....	.....	.....	.....	.....
Ayrshire.	Junietta Peerless.	.....	.....	1.50	0.70	1.27	0.59	.....	.....
Ayrshire.	Manton Belle.	1.45	0.67	1.73	0.80	1.54	0.72	1.33	0.62
Ayrshire.	Miss Flow 5th.	2.03	0.94	1.70	0.79	1.66	0.77	1.82	0.85
Ayrshire.	Queen Duchess.	1.51	0.70	1.45	0.67	.....	.....	.....	.....
Devon.	Artalia.	1.79	0.83	.....	.....	.....	.....	.....	.....
Devon.	Genevieve's Gift.	2.02	0.94	2.08	0.97	.....	.....	.....	.....
Devon.	Ione.	1.98	0.92	2.29	1.06	.....	.....	.....	.....
Guernsey.	Madame Select.	.....	.....	2.13	0.99	.....	.....	.....	.....
Guernsey.	Oriole.	1.58	0.73	1.72	0.80	.....	.....	.....	.....
Guernsey.	Rosette Ford.	1.80	0.83	1.93	0.90	.....	.....	.....	.....
Guernsey.	Stella Select.	1.91	0.89	.....	.....	.....	.....	.....	.....
Holstein-Friesian.	Beauty Pledge.	.....	.....	1.25	0.58	.....	.....	.....	.....
Holstein-Friesian.	Esel 2d.	1.55	0.72	.....	.....	.....	.....	.....	.....
Holstein-Friesian.	Netherland Constance.	1.30	0.60	.....	.....	.....	.....	.....	.....
Holstein-Friesian.	Ruth.	1.46	0.68	.....	.....	.....	.....	.....	.....
Jersey.	Albert's Carol.	2.10	0.98	2.09	0.97	.....	.....	.....	.....
Jersey.	Barbara Allen.	2.05	0.95	2.00	0.93	1.68	0.78	.....	.....
Jersey.	Countess Flavia.	2.10	0.98	1.90	0.98	2.01	0.93	1.69	0.79
Jersey.	Gilderbloom.	2.24	1.04	.....	.....	1.65	0.77	.....	.....
Shorthorn.	Betsy 10th.	1.89	0.88	1.47	0.68	.....	.....	.....	.....

TABLE B.—SHOWING AVERAGE COST OF ONE QUART AND ONE POUND OF MILK.

BREED.	FIRST PERIOD OF LACTATION.		SECOND PERIOD OF LACTATION.		THIRD PERIOD OF LACTATION.		FOURTH PERIOD OF LACTATION.		AVERAGE OF ALL PERIODS OF LACTATION.	
	Cents per quart.	Cents per pound.	Cents per quart.	Cents per pound.	Cents per quart.	Cents per pound.	Cents per quart.	Cents per pound.	Cents per quart.	Cents per pound.
American Holderness.	1.55	0.72	1.66	0.77	1.74	0.81	.....	.....	1.63	0.76
Ayrshire .....	1.63	0.76	1.58	0.74	1.46	0.68	1.55	0.73	1.58	0.74
Devon .....	1.91	0.89	2.19	1.02	2.02	0.94	.....	.....	2.02	0.94
Guernsey .....	1.76	0.82	1.91	0.89	.....	.....	.....	.....	1.85	0.86
Holstein-Friesian .....	1.44	0.67	1.25	0.58	.....	.....	.....	.....	1.39	0.65
Jersey .....	2.13	0.99	2.00	0.93	1.76	0.82	1.69	0.79	1.95	0.90
Shorthorn .....	1.89	0.83	1.47	0.68	.....	.....	.....	.....	1.68	0.78

TABLE C—SHOWING SUMMARY OF MILK.

BREED.	Number of cows.	Total number of periods of lactation	ACTUAL AVERAGE COST OF MILK.		Relative cost of milk.
			Cents per quart.	Cents per pound.	
Holstein-Friesian.....	4	4	1.39	0.65	100
Ayrshire .....	4	12	1.58	0.74	114
American Holderness .....	2	4	1.63	0.76	117
Shorthorn .....	1	2	1.68	0.78	120
Guernsey .....	4	6	1.85	0.86	132
Jersey .....	4	11	1.95	0.90	139
Devon .....	3	5	2.02	0.94	145

## 4. POUNDS OF MILK-SOLIDS PRODUCED.

In order that we may have an approximate idea of the composition of the milk we give the amount of solids present in the milk.

TABLE A—SHOWING AMOUNT OF MILK-SOLIDS PRODUCED.

Breed.	NAME OF COW.	PERIOD OF LACTATION.			
		First.	Second.	Thrd.	Fourth.
		Pounds.	Pounds.	Pounds.	Pounds.
American Holderness	Maggie 6th	579.6	786.7	762.5	.....
American Holderness	Nora	767.5	.....	.....	.....
Ayrshire	Junietta Peerless	.....	902.4	1075.8	.....
Ayrshire	Manton Belle	773.8	886.1	1011.3	980.5
Ayrshire	Mrs Flow 5th	696.7	661.8	856.0	788.2
Ayrshire	Queen Duchess	927.2	972.2	.....	.....
Devon	Artalia	781.8	.....	.....	.....
Devon	Genevieve's Gift	442.9	591.9	.....	.....
Devon	Ione	536.1	564.4	.....	.....
Guernsey	Madame Select	.....	778.6	.....	.....
Guernsey	Oriole	745.8	887.2	.....	.....
Guernsey	Rosette Ford	705.6	949.8	.....	.....
Guernsey	Stella Select	756.5	.....	.....	.....
Holstein-Friesian	Beauty Pledge	.....	1086.9	.....	.....
Holstein-Friesian	Esel 2d	949.4	.....	.....	.....
Holstein-Friesian	Netherland Constance	1062.0	.....	.....	.....
Holstein-Friesian	Ruth	697.6	.....	.....	.....
Jersey	Albert's Carol	714.6	685.1	.....	.....
Jersey	Barbara Allen	686.4	782.8	947.0	.....
Jersey	Countess Flavia	794.1	827.8	757.8	891.1
Jersey	Gliderbloom	608.6	.....	884.5	.....
Shorthorn	Betsey 10th	724.0	1008.4	.....	.....

TABLE B—SHOWING AVERAGE AMOUNT OF MILK-SOLIDS PRODUCED.

BREED.	FIRST PERIOD OF LACTATION.		SECOND PERIOD OF LACTATION.		THIRD PERIOD OF LACTATION.		FOURTH PERIOD OF LACTATION.		Pounds of milk-solids, all periods of lactation.
	Number of cows.	Pounds of milk-solids.	Number of cows.	Pounds of milk-solids.	Number of cows.	Pounds of milk-solids.	Number of cows.	Pounds of milk-solids.	
American Holderness	2	673.5	1	786.7	1	762.5	.....	.....	724.1
Ayrshire	3	799.1	4	843.1	3	980.9	2	859.4	869.4
Devon	3	576.9	2	578.2	.....	.....	.....	.....	577.4
Guernsey	3	736.0	3	871.7	.....	.....	.....	.....	804.0
Holstein-Friesian	3	903.0	1	1036.9	.....	.....	.....	.....	936.5
Jersey	4	700.9	3	765.1	3	846.4	1	891.1	775.4
Shorthorn	1	734.0	1	1008.4	.....	.....	.....	.....	866.2

TABLE C — SHOWING SUMMARY OF AMOUNT OF MILK-SOLIDS PRODUCED.

BREED.	Number of cows	Total number of periods of lactation.	Actual average yield of milk-solids per cow for all periods of lactation	Relative yield of milk-solids.
			Pounds.	
Devon .....	3	5	577.4	100
American Holderness .....	2	4	724.1	125
Jersey .....	4	11	775.4	134
Guernsey .....	4	6	804.0	139
Shorthorn .....	1	2	866.2	150
Ayrshire .....	4	12	869.4	151
Holstein-Friesian .....	4	4	936.5	162

#### 5. PER CENT. OF SOLIDS IN MILK.

We have seen in the foregoing tables the total amount of milk-solids produced by the animals, and we will now present data, giving the amount of milk-solids in 100 pounds of milk :

TABLE A—SHOWING PER CENT. OF MILK-SOLIDS IN MILK.

Breed.	NAME OF COW.	PERIOD OF LACTATION.			
		First.	Second.	Thrd.	Fourth.
		Per cent.	Per cent.	Per cent.	Per cent.
American Holderness.	Maggie 6th.	12.33	12.87	12.92	.....
American Holderness.	Nora.	12.45	.....	.....	.....
Ayrshire.	Junietta Peerless.	.....	12.86	12.11	.....
Ayrshire.	Manton Belle.	12.28	13.24	12.43	12.05
Ayrshire.	Miss Flow 5th.	13.60	12.95	13.15	12.95
Ayrshire.	Queen Duchess.	13.26	13.32	.....	.....
Devon.	Artalia.	14.59	.....	.....	.....
Devon.	Genevie's Gift.	14.52	14.77	.....	.....
Devon.	Ione.	14.10	14.46	.....	.....
Guernsey.	Madame Select.	.....	16.32	.....	.....
Guernsey.	Oriole.	14.84	14.74	.....	.....
Guernsey.	Rosette Ford.	14.50	15.53	.....	.....
Guernsey.	Stella Select.	14.18	.....	.....	.....
Holstein-Friesian.	Beauty Pledge.	.....	12.11	.....	.....
Holstein-Friesian.	Esel 2d.	12.98	.....	.....	.....
Holstein-Friesian.	Netherland Constance.	11.23	.....	.....	.....
Holstein-Friesian.	Ruth.	11.00	.....	.....	.....
Jersey.	Albert's Carol.	15.13	15.62	.....	.....
Jersey.	Barbara Allen.	14.87	15.10	14.76	.....
Jersey.	Countess Flavia.	15.50	16.16	16.16	15.60
Jersey.	Gilderbloom.	15.22	16.48	14.78	.....
Shorthorn.	Betsy 10th.	14.42	14.23	.....	.....

TABLE B—SHOWING AVERAGE PER CENT. OF MILK-SOLIDS IN MILK.

BREED.	First period of lactation.	Second period of lactation.	Third period of lactation.	Fourth period of lactation.	Average of all periods of lactation.
	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.
American Holderness.	12.40	12.87	12.92	.....	12.66
Ayrshire .....	13.01	12.96	12.51	12.45	12.74
Devon .....	14.42	14.62	.....	.....	14.50
Guernsey .....	14.34	15.47	.....	.....	14.93
Holstein-Friesian.....	11.72	12.11	.....	.....	11.83
Jersey .....	15.18	15.74	.....	.....	15.37
Shorthorn .....	14.42	14.22	15.16	15.60	14.30

TABLE C—SHOWING SUMMARY OF AVERAGE PER CENT. OF MILK-SOLIDS.

BREED.	Number of cows	Total number of periods of lactation.	Average per cent. of milk-solids.	Relative proportion of milk-solids.
Holstein-Friesian.....	4	4	11.83	100
American Holderness.....	2	4	12.66	107
Ayrshire.....	4	12	12.74	108
Shorthorn .....	1	2	14.30	121
Devon.....	3	5	14.50	123
Guernsey .....	4	6	14.93	126
Jersey.....	6	11	15.37	130

6. COST OF ONE POUND OF MILK-SOLIDS.  
TABLE A — SHOWING COST OF MILK-SOLIDS.

Bred.	NAME OF COW.	PERIOD OF LACTATION.			
		FIRST.	SECOND.	THIRD.	FOURTH.
		Cents per pound.	Cents per pound.	Cents per pound.	Cents per pound.
American Holderness	Maggie 6th.	6.17	6.00	6.23	.....
American Holderness	Nora	4.92	.....	.....	.....
Ayrshire	Junietta Peerless	.....	5.64	4.88	.....
Ayrshire	Manton Belle	5.47	6.09	5.77	5.14
Ayrshire	Miss Flow 5th.	6.98	6.10	5.88	6.55
Ayrshire	Queen Duchess	5.28	5.07	.....	.....
Devon	Artalia	5.71	.....	.....	.....
Devon	Genevie's Gift	6.48	6.54	.....	.....
Devon	Lone	6.55	7.44	.....	.....
Guernsey	Madame Select	.....	6.09	.....	.....
Guernsey	Ortolo	5.12	5.41	.....	.....
Guernsey	Rosette Ford	5.80	5.80	.....	.....
Guernsey	Stella Select	6.27	.....	.....	.....
Holst-in-Frisian	Beauty Pledge	.....	4.78	.....	.....
Holst-in-Frisian	Esel 2d.	5.55	.....	.....	.....
Holst-in-Frisian	Netherland Constance	5.41	.....	.....	.....
Holst-in-Frisian	Ruth	6.19	.....	.....	.....
Jersey	Albert's Carol	6.48	6.23	.....	.....
Jersey	Barbara Allen	6.43	6.15	6.82	.....
Jersey	Countess Flavia	6.80	5.45	5.80	5.06
Jersey	Gilderbloom	6.85	.....	5.19	.....
Shorthorn	Bebsey 10th.	6.08	4.80	.....	.....

TABLE B—SHOWING AVERAGE COST OF ONE POUND OF MILK-SOLIDS.

BREED.	First period of lactation.	Second period of lactation.	Third period of lactation.	Fourth period of lactation.	Average of all periods of lactation.
	Cents. Per pound.	Cents. Per pound.	Cents. Per pound.	Cents. Per pound.	Cents. Per pound.
American Holderness.	5.69	6.00	6.23	.....	5.93
Ayrshire .....	5.83	5.62	5.47	5.78	5.68
Devon .....	6.17	7.00	.....	.....	6.50
Guernsey .....	5.73	5.73	.....	.....	5.73
Holstein-Friesian ....	5.66	4.78	.....	.....	5.42
Jersey .....	6.49	5.92	5.41	5.06	5.87
Shorthorn .....	6.08	4.80	.....	.....	5.34

TABLE C—SHOWING SUMMARY OF AVERAGE COST OF MILK-SOLIDS.

BREED.	Number of cows	Total number of periods of lac- tation.	Actual average cost of milk- solids per pound for all periods of lac- tation.	Relative cost of milk-solids.
			Cents.	
Shorthorn .....	1	2	5.34	100
Holstein-Friesian .....	4	4	5.42	102
Ayrshire .....	4	12	5.68	106
Guernsey .....	4	6	5.73	107
Jersey .....	4	11	5.87	110
American Holderness .....	2	4	5.93	111
Devon .....	3	5	6.50	122

## 7. MONEY VALUE OF MILK PRODUCED BY DIFFERENT BREEDS.

The final test of a cow's value for dairy purposes is the amount of profit to be derived from her. In calculating the money value of milk, we may be guided solely by the amount of milk produced, allowing a fixed price for a pound of milk, regardless of composition; or we may consider the composition of the milk and fix a price which shall be dependent upon the composition. In calculating the money value of milk as based on its composition, we can use the total solids of the milk or the fat alone.

For the sake of comparison, we, therefore, give three values for milk in the tables following: first, the money value of milk calculated on the basis of two and three-fourths cents per quart or

1.28 cents per pound; second, the money value of the milk calculated on the basis of the milk-solids at nine and one third cents per pound; and, third, the money value of the milk calculated on the basis of milk-fat at  $26\frac{1}{2}$  cents per pound.

If we take the value of all the milk produced by all the cows as calculated at 1.28 cents per pound and divide this by the total number of pounds of milk-solids produced by all the cows, then we get, as the average selling price of one pound of milk solids, nine and one-third cents. In other words, with milk selling at 1.28 cents per pound, milk solids have an equivalent value of nine and one third cents per pound. In a similar way, milk-fat has an equivalent value of  $26\frac{1}{2}$  cents per pound.

TABLE A — SHOWING MONEY VALUE OF MILK PRODUCED.

Breed.	NAME OF COW.	FIRST PERIOD OF LACTATION.			SECOND PERIOD OF LACTATION.			THIRD PERIOD OF LACTATION.			FOURTH PERIOD OF LACTATION.		
		Milk at 1.28 cents per pound.	Milk-solids at 1½¢ per pound.	Milk-fat at 20½¢ per pound.	Milk at 1.28 cents per pound.	Milk-solids at 9½¢ per pound.	Milk-fat at 16½¢ per pound.	Milk at 1.18 cents per pound.	Milk-solids at 9½¢ per pound.	Milk-fat at 16½¢ per pound.	Milk at 1.28 cents per pound.	Milk-solids at 9½¢ per pound.	Milk-fat at 20½¢ per pound.
American Holderness	Maggie 6th.....	\$90.18	\$4.10	\$48.21	\$78.25	\$73.48	\$69.88	\$75.56	\$71.17	\$60.94	.....	.....	.....
American Holderness	Nora.....	78.90	71.63	80.44	.....	.....	.....	.....	.....	.....	.....	.....	.....
Ayrshire	Junietta Peerless.....	.....	.....	.....	98.41	84.28	61.46	113.66	100.26	80.16	.....	.....	.....
Ayrshire	Manion Bell.....	80.59	71.18	55.28	98.94	78.04	61.69	104.17	91.29	77.08	93.88	88.88	\$70.23
Ayrshire	Miss Plow 5th.....	65.57	65.08	57.22	65.43	61.77	46.25	88.20	79.90	60.94	77.59	73.57	63.23
Ayrshire	Queen Duchess.....	89.43	86.54	71.31	98.43	90.74	70.28	.....	.....	.....	.....	.....	.....
Devon	Artalia.....	64.19	66.20	87.17	.....	.....	.....	.....	.....	.....	.....	.....	.....
Devon	Genevieve's Gift.....	29.03	41.24	36.18	51.19	55.31	55.23	.....	.....	.....	.....	.....	.....
Devon	Lone.....	50.43	51.90	45.21	49.97	58.68	46.06	.....	.....	.....	.....	.....	.....
Guernsey	Madame Select.....	.....	.....	.....	61.06	73.67	77.00	.....	.....	.....	.....	.....	.....
Guernsey	Oricle.....	66.59	60.61	86.84	77.00	88.81	85.87	.....	.....	.....	.....	.....	.....
Guernsey	Rosette Ford.....	61.30	65.86	63.70	78.25	88.60	92.27	.....	.....	.....	.....	.....	.....
Guernsey	Stella Select.....	68.23	70.61	63.28	.....	.....	.....	.....	.....	.....	.....	.....	.....
Holstein-Friesian	Beauty Pledge.....	.....	.....	74.18	109.57	96.78	85.00	.....	.....	.....	.....	.....	.....
Holstein-Friesian	Es-1 2d.....	98.63	88.51	74.18	.....	.....	.....	.....	.....	.....	.....	.....	.....
Holstein-Friesian	Netherland Constance.....	121.06	90.13	73.97	.....	.....	.....	.....	.....	.....	.....	.....	.....
Holstein-Friesian	Ruth.....	81.13	65.11	46.11	.....	.....	.....	.....	.....	.....	.....	.....	.....
Jersey	Albert's Carol.....	60.47	66.70	84.31	56.14	63.94	67.58	.....	88.29	91.45	.....	.....	.....
Jersey	Barbara Allen.....	59.03	64.05	64.60	66.34	73.05	67.68	83.13	80.39	76.16	73.15	83.17	91.59
Jersey	Countess Flavia.....	65.80	74.13	77.53	64.22	77.28	76.95	.....	60.10	70.73	.....	.....	.....
Jersey	Gliderbloom.....	51.30	56.80	59.54	.....	.....	.....	73.34	77.80	81.06	.....	.....	.....
Shorthorn	Bessy 10th.....	64.24	67.54	56.54	80.76	94.13	87.51	.....	.....	.....	.....	.....	.....

TABLE B — SHOWING AVERAGE MONEY VALUE OF MILK PRODUCED.

BREED.	FIRST PERIOD OF LACTATION.				SECOND PERIOD OF LACTATION.				THIRD PERIOD OF LACTATION.				FOURTH PERIOD OF LACTATION.				AVERAGE OF ALL PERIODS OF LACTATION.			
	Milk at 1.25 cents per pound.	Milk-solids at 12% per pound.	Milk-fat at 150 cents per pound.	Milk at 1.25 cents per pound.	Milk-solids at 12% per pound.	Milk-fat at 150 cents per pound.	Milk at 1.25 cents per pound.	Milk-solids at 12% per pound.	Milk-fat at 150 cents per pound.	Milk at 1.25 cents per pound.	Milk-solids at 12% per pound.	Milk-fat at 150 cents per pound.	Milk at 1.25 cents per pound.	Milk-solids at 12% per pound.	Milk-fat at 150 cents per pound.	Milk at 1.25 cents per pound.	Milk-solids at 12% per pound.	Milk-fat at 150 cents per pound.		
American Holsteins .....	\$4.24	\$3.67	\$1.61	\$78.95	\$73.45	\$69.58	\$78.56	\$71.17	\$60.94	\$88.39	\$80.21	\$66.26	\$73.92	\$67.34	\$63.58	\$73.92	\$67.34	\$63.58		
Ayrshire .....	5.73	5.53	2.37	88.29	81.54	69.78	100.39	91.55	72.71	100.39	91.55	72.71	100.39	91.55	72.71	100.39	91.55	72.71		
Devon .....	4.73	4.69	1.81	59.44	51.54	45.45	59.44	51.54	45.45	59.44	51.54	45.45	59.44	51.54	45.45	59.44	51.54	45.45		
Guernsey .....	5.76	5.43	2.46	72.11	64.24	52.09	72.11	64.24	52.09	72.11	64.24	52.09	72.11	64.24	52.09	72.11	64.24	52.09		
Holstein-Friesian .....	6.08	5.43	2.46	103.57	98.74	85.73	71.45	79.00	82.55	73.15	68.17	61.69	64.93	61.69	57.47	64.93	61.69	57.47		
Jersey .....	4.94	4.66	1.90	68.90	61.11	50.70	71.45	79.00	82.55	73.15	68.17	61.69	64.93	61.69	57.47	64.93	61.69	57.47		
Shorthorn .....	6.94	6.75	2.54	80.76	74.12	67.15	71.45	79.00	82.55	73.15	68.17	61.69	64.93	61.69	57.47	64.93	61.69	57.47		

It will be seen that the money value of the milk differs considerably when calculated on the basis of quantity of milk or on the amount of milk solids or of fat. In the case of milk low in solids, the basis of quantity of milk gives a higher money value than the basis of quantity of milk solids, while the reverse is true of milk high in solids or fat.

Below we give the tabulated averages according to breeds.

In the table following, we present a summary showing the average money value of the milk produced by the different breeds according to the three methods of valuation given above for all periods of lactation.

TABLE C—SHOWING SUMMARY OF AVERAGE MONEY VALUE OF MILK OF DIFFERENT BREEDS.

BREED.	Number of cows.	Total number of lactations.	VALUE OF MILK AT 1.28 CENTS PER POUND.		VALUE OF MILK BASED ON MILK-SOLIDS AT 9% CENTS PER POUND.		VALUE OF MILK BASED ON MILK-FAT AT 28% CENTS PER POUND.	
			Actual.	Relative.	Actual.	Relative.	Actual.	Relative.
Devon .....	3	5	\$51 00	100	\$53 89	100	\$48 27	100
Jersey .....	4	11	64 58	127	72 37	134	74 30	154
Guernsey .....	4	6	68 93	135	75 04	139	75 18	156
Shorthorn .....	1	2	72 50	142	80 85	151	72 03	149
American Holderness .....	2	4	73 22	144	67 58	125	56 12	116
Ayrshire .....	4	12	87 24	171	81 14	151	64 47	134
Holstein-Friesian .....	4	4	101 35	199	87 41	162	50 07	145

### 8. PROFIT DERIVED FROM SELLING MILK PRODUCED BY DIFFERENT BREEDS OF DAIRY COWS.

In considering the profit derived from selling milk, we must fix on a uniform system of valuation. We have presented calculations based on three different methods for fixing the money value of milk when sold for consumption as milk. Which of these methods will serve our purpose most fairly for making a comparison of the approximate value of milk? While the milk-fat furnishes the only fair and practicable basis for determining the value of milk that is to be made into butter or cheese, and while this method could also be utilized in enabling us to make a valuation of milk, that is to be sold for consumption as milk, we shall probably approximate more closely the actual market value of milk as now sold, by making the milk-solids our basis of valuation. Therefore, in making our comparison of profits derived from selling milk, we will make use of the value furnished by this method of calculation. If from the selling value of the milk, thus found, we subtract the cost of food eaten by the animals, we obtain the approximate amount of profit. However, when the milk is taken from the farm and no part retained in any form, a certain amount of food and fertilizing material is removed, which the dairyman must replace in some form. To illustrate, when we sell and carry away from the farm 1000 pounds of average milk for \$12.50, we take from the farm materials which have a food and fertilizing value of 25 cents for each 100 pounds of milk or \$2.50 for the 1000 pounds of milk. By retaining the skim milk and buttermilk and selling only the fat in the form of butter, we could secure the same amount of money for 1000 pounds of milk and still retain on the farm the materials which are worth \$2.50 for food and fertilizer. Therefore, when we take the milk from the farm, we must, for each 1000 pounds, pay out from the money received \$2.50 to replace the food and fertilizing materials sent away in the milk, if we are to keep the farm and animals in the condition we should, when we retain on the farm the skim milk and buttermilk. In theory, then, at least, of the \$12.50 received for the milk, we must pay out \$2.50 to buy food and fertilizer to take the place of that removed in the milk sold, and the actual profit derived from selling 1000 pounds of milk would be \$2.50 less than the apparent profit.

In regard to the actual market value, skim-milk can be purchased at creameries for  $12\frac{1}{2}$  cents per 100 pounds, or one-half of what we usually rate it for in theory. Since this is so, it will represent actual results more closely, if we deduct the latter amount in determining actual profits.

We, therefore, present tabulated results showing the apparent and actual profit derived from selling milk. In determining the amount of money to be deducted for feeding and fertilizing values, we use the solids-not-fat as a basis for calculation, because the skim-milk of different breeds varies in both feeding and fertilizing value. We deduct the amount of fat which would, in butter-making, go into butter, from the entire yield of milk-solids. The remaining solids, mostly not fat, would have a theoretical value of about three cents per pound but a market value of half this, since, as pointed out above, skim-milk can be purchased at one-half of its real feeding and fertilizing value. By using the solids as a basis of determining the value of the skim-milk, we secure results that represent the truth more nearly than we should if we rated all the skim-milk at the same price per 100 pounds, regardless of its composition.

In the tables following we therefore present, first, the amount of apparent profit, that is, the total receipts less the food eaten; second, the calculated feeding and fertilizing value of the skim milk and buttermilk; third, the market value of the skim milk, which is one-half the calculated value; fourth, the actual profit (No. 1) obtained by deducting the calculated value of skim milk, etc., from the apparent profit; and, fifth, the actual profit (No. 2) obtained by deducting the market value of skim-milk, etc., from the apparent profit.

TABLE A—SHOWING APPARENT AND ACTUAL PROFITS DERIVED FROM SELLING MILK.

Breed.	NAME OF COW.	FIRST PERIOD OF LACTATION.				SECOND PERIOD OF LACTATION.			
		Apparent profit.	Calculated value of skim-milk, etc.	Actual profit No. 1.	Market value of skim-milk, etc.	Actual profit No. 2.	Apparent profit.	Calculated value of skim-milk, etc.	Actual profit No. 1.
American Holderness.	Maggie 6th.	\$15.30	\$12.50	\$2.81	\$6.35	\$9.15	\$36.38	\$17.07	\$19.31
	Nora	33.85	16.44	17.41	8.92	25.93			
Ayrshire	Junietta Peerless								
	Manton Belle	26.88	17.19	11.69	8.60	20.29	27.14	18.44	18.70
	Miss Flow 8th.	16.53	14.63	1.90	7.33	9.24	21.27	14.83	6.44
	Queen Duchess	27.54	20.08	17.51	10.02	27.53	41.44	21.50	19.94
Devon	Arialis	26.50	15.85	10.65	7.84	18.66			
	Genevieve's Gift.	13.64	9.09	4.55	4.55	8.10	16.54	11.66	4.88
Devon	Louie	15.50	11.75	3.75	5.19	9.61	10.63	11.79	1.11
Guernsey	Madame Select.								
	Orlone	31.41	14.79	16.63	7.08	24.55	25.27	14.81	10.46
	Rosette Ford	24.96	14.15	10.81	7.40	17.56	33.60	17.13	17.60
	Stella Select.	28.31	15.74	7.47	7.87	15.84	33.60	18.26	15.34
Holstein-Friesian	Beauty Pledge						47.28	21.84	25.44
	Esel 2d	25.81	20.36	15.43	10.19	25.63			
	Holstein Friesland	41.61	24.00	17.62	13.00	29.62			
	Netherland Constance	21.94	15.75	6.19	7.88	14.06			
Jersey	Albert's Carol	20.40	14.34	6.06	7.17	13.23	21.23	13.07	8.16
	Barbara Allen	19.96	13.46	6.50	6.73	13.23	34.56	16.03	9.53
	Countess Flavia	24.12	15.23	8.89	7.61	16.50	22.13	16.30	15.83
	Gilderbloom	15.10	11.67	3.43	5.83	9.36			
Shorthorn	Bessy 10th.	23.54	15.53	8.01	7.76	15.78	45.67	20.89	24.78

\* Loss.

TABLE A—SHOWING APPARENT AND ACTUAL PROFITS, ETC.—( *continued* ).

Breed.	NAME OF COW.	THIRD PERIOD OF LACTATION.					FOURTH PERIOD OF LACTATION.				
		Apparent profit.	Calculated value of skim-milk, etc.	Actual profit No. 1.	Market value of skim-milk, etc.	Actual profit No. 2.	Apparent profit.	Calculated value of skim-milk, etc.	Actual profit No. 1.	Market value of skim-milk, etc.	Actual profit No. 2.
American Holderness.	Maggie 6th.	\$33 47	\$16 33	\$7 25	\$3 11	\$15 36	.....	.....	.....	.....	.....
American Holderness.	Nora.	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Ayrshire.	Junietta Peerless.	47 95	23 55	24 41	11 73	31 19	.....	.....	.....	.....	.....
Ayrshire.	Manion Belle.	35 92	31 97	14 02	10 52	26 00	.....	.....	.....	.....	.....
Ayrshire.	Miss Flow 5th.	39 52	19 04	10 55	9 53	20 07	.....	.....	.....	.....	.....
Ayrshire.	Queen Duchess.	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Devon.	Artalia.	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Devon.	Genevieve's Gift.	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Devon.	Lois.	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Guernsey.	Madame Select.	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Guernsey.	Orlole.	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Guernsey.	Rosette Ford.	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Guernsey.	Stella Select.	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Holstein-Friesian.	Beauty Pledge.	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Holstein-Friesian.	Es-l 3d.	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Holstein-Friesian.	Netherland Constance.	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Holstein-Friesian.	Ruth.	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Jersey.	Albert's Carol.	33 19	18 30	19 59	9 15	20 04	.....	.....	.....	.....	.....
Jersey.	Barbara Allen.	26 53	14 39	13 44	7 30	19 64	.....	.....	.....	.....	.....
Jersey.	Countess Flavia.	34 59	16 08	15 51	8 04	23 55	.....	.....	.....	.....	.....
Jersey.	Gilderbloom.	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Shorthorn.	Betsy 10th.	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....

TABLE B—SHOWING APPARENT AND ACTUAL AVERAGE PROFIT PER COW FOR EACH BREED.

BREED.	FIRST PERIOD OF LACTATION.					SECOND PERIOD OF LACTATION.				
	(1) Apparent profit.	(2) Calculated value of skim-milk, etc.	(3) Actual profit No. 1.	(4) Market value of skim-milk, etc.	(5) Actual profit No. 2.	(1) Apparent profit.	(2) Calculated value of skim-milk, etc.	(3) Actual profit No. 1.	(4) Market value of skim-milk, etc.	(5) Actual profit No. 2.
American Holsteins.....	\$24.58	\$14.57	\$0.96	\$7.30	\$17.26	\$36.23	\$17.07	\$2.16	\$8.54	\$17.70
Ayrshire .....	27.65	17.26	10.37	8.84	19.01	30.83	18.80	12.02	9.40	21.43
Devon. ....	18.21	12.18	6.03	6.08	12.12	13.61	11.73	1.89	5.86	7.75
Guernsey .....	26.53	14.90	11.63	7.45	19.08	31.23	16.72	14.50	8.37	23.87
Holstein-Friesian .....	33.12	20.04	13.08	10.03	22.10	47.23	21.84	25.39	10.91	26.31
Jersey .....	19.90	13.65	6.25	6.84	12.06	26.0	15.12	10.93	7.56	13.54
Shorthorn.....	23.54	15.52	8.02	7.76	15.73	45.67	20.59	24.73	10.45	25.23

TABLE B—SHOWING APPARENT AND ACTUAL AVERAGE PROFIT, ETC.—(Concluded).

BREED.	THIRD PERIOD OF LACTATION.					FOURTH PERIOD OF LACTATION.					AVERAGE OF ALL PERIODS OF LACTATION.				
	Apparent profit.	Calculated value of skim-milk, etc.	Actual profit No. 1.	Market value of skim-milk, etc.	Actual profit No. 2.	Apparent profit.	Calculated value of skim-milk, etc.	Actual profit No. 1.	Market value of skim-milk, etc.	Actual profit No. 2.	Apparent profit.	Calculated value of skim-milk, etc.	Actual profit No. 1.	Market value of skim-milk, etc.	Actual profit No. 2.
American Holderness.....	\$28 47	\$16 33	\$7 36	\$8 11	\$15 54	\$30 50	\$18 57	\$11 93	\$9 59	\$31 93	\$24 60	\$15 61	\$9 06	\$7 81	\$16 89
Ayrshire.....	27 85	21 52	16 33	10 76	27 09	30 50	18 57	11 93	9 59	31 93	21 73	19 06	12 67	9 53	23 90
Devon.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Guernsey.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Holstein-Friesian.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Jersey.....	33 30	16 35	16 06	8 13	25 06	33 10	16 57	21 53	8 59	30 89	28 65	20 49	16 16	10 35	28 40
Shorthorn.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	24 60	18 50	16 40	9 10	26 50

TABLE C — SHOWING SUMMARY OF APPARENT AND ACTUAL AVERAGE PROFITS DERIVED FROM SELLING MILK.

BREED.	Number of cows.	Total number of lactation periods.	Apparent profit.	Calculated value of skim-milk, etc.	Actual profit No. 1.	Market values of skim-milk, etc.	Actual profit No. 2.	Relative order of apparent profit.	Relative order of actual profit No. 1.	Relative order of actual profit No. 2.
Devon .....	3	5	\$16 37	\$13 00	\$4 37	\$6 00	\$10 37	100	100	100
Jersey .....	4	11	24 63	13 78	10 85	6 89	17 74	150	250	171
American Holderness .....	2	4	24 69	15 61	9 08	7 81	16 89	151	208	163
Guernsey .....	4	6	28 88	15 81	13 07	7 90	20 97	177	300	202
Ayrshire .....	4	12	31 73	19 06	12 67	9 53	22 20	194	290	214
Shorthorn .....	1	2	34 60	18 20	16 40	9 10	25 50	211	375	245
Holstein-Friesian .....	4	4	36 65	20 49	16 16	10 25	26 40	224	370	255

### 9. PRODUCTION OF MILK FOR CONDENSED-MILK FACTORIES.

The amount of total solids of normal milk renders a milk more or less valuable for purposes of making condensed milk. The normal milk with the largest amount of solids has a higher value for this purpose than milk with a smaller amount of solids. We have previously given the per cent. of milk-solids in the milk of different cows and breeds, and the total amount of milk-solids produced by each, and also the value of the milk based on the milk-solids at nine and one-third cents per pound. Therefore, the figures previously given apply in detail to the value of milk in relation to its use for the manufacture of condensed milk.

### 10. GENERAL SUMMARY.

In the tables following we present, first, the actual breed averages of all the results obtained thus far; and second, the relative results, based, in each case, on the lowest result taken as 100.

TABULATED SUMMARY GIVING COMPARISON OF RESULTS SECURED WITH DIFFERENT BREEDS OF DAIRY CATTLE WITH REFERENCE TO THE PRODUCTION OF MILK—AVERAGE PER COW FOR ONE PERIOD (10 MONTHS), OF LACTATION.

	American Holsteins.	Ayrshire.	Devon.	Guernsey.	Holstein-Friesian.	Jersey.	Shorthorn.
Number of cows.....	2	4	3	4	4	4	1
Total number of periods of lactation.	4	12	5	6	4	11	2
Cost of food eaten.....	\$43 90	\$49 32	\$37 52	\$46 15	\$50 73	\$45 49	\$46 23
Pounds of milk given.....	5721	8324	3984	5385	7918	5045	6055
Cost of milk in cents per lb.....	0.76	0.74	0.94	0.86	0.65	0.90	0.78
Cost of milk in cents per quart....	1.63	1.68	2.02	1.85	1.39	1.95	1.68
Pounds of milk solids produced....	724.1	869.4	577.4	804.0	936.5	775.4	866.2
Per cent. of solids in milk.....	13.66	13.74	14.50	14.93	11.83	15.37	14.30
Cost of milk-solids in cents per lb..	5.93	5.68	6.50	5.73	5.42	5.87	5.34
Money value of milk at 1.28 cts. per lb.	\$73 22	\$87 24	\$51 00	\$68 93	\$101 35	\$64 54	\$72 50
Money value of milk based on milk-solids at 9½ cents per lb.....	67 58	81 14	53 89	75 04	87 41	72 37	80 85
Money value of milk based on milk-fat at 26½ cents per lb.....	56 13	64 47	48 27	75 18	70 07	74 30	72 03
Apparent profit (money value of milk less cost of food).....	24 69	31 73	16 37	28 88	36 65	24 63	34 60
Calculated value of skim-milk.....	15 61	19 06	12 00	15 81	20 49	13 78	18 20
Market value of skim-milk.....	7 81	9 53	6 00	7 90	10 25	6 89	9 10
Actual profit (apparent profit less market value of skim-milk).....	16 89	22 20	10 37	20 97	26 40	17 74	25 50

TABULATED SUMMARY SHOWING RELATIVE RESULTS OF COMPARISON FOR DIFFERENT BREEDS OF CATTLE WITH  
REFERENCE TO PRODUCTION OF MILK—FIGURES BASED ON LOWEST RESULTS AS 100.

	American Holderness	Ayrshire.	Devon.	Guernsey	Holstein- Friesian.	Jersey.	Shorthorn.
Relative cost of food eaten .....	114	131	100	123	135	121	123
Relative amount of milk produced .....	144	172	100	135	199	127	152
Relative cost of milk .....	117	114	145	132	100	139	120
Relative amount of milk-solids produced .....	125	151	100	139	162	134	150
Relation of per cent. of milk-solids .....	107	108	123	126	100	130	121
Relative cost of milk solids .....	111	106	122	107	102	110	100
Relative value of milk at 1 2¢ cents per pound .....	144	171	100	135	199	127	142
Relative value of milk based on solids at 9½ cents per pound .....	125	151	100	139	162	134	150
Relative value of milk based on fat at 26½ cents per pound .....	116	134	100	156	145	154	149
Relative apparent profit from milk .....	151	194	100	177	224	150	211
Relative actual profit from milk .....	163	214	100	202	255	171	245

## VI. COMPARISON OF DIFFERENT BREEDS OF DAIRY COWS WITH REFERENCE TO THE PRODUCTION OF CREAM AND BUTTER.

### METHOD OF DETERMINING AMOUNT OF BUTTER PRODUCTION.

The butter production is calculated from the amount of fat in the milk as follows: From the amount of fat in 100 pounds of milk, we subtract 0.16 pound, which represents the amount of fat lost for 100 pounds of milk, in skim-milk and buttermilk and in handling. The remainder is the amount of fat that goes into butter, and the amount of butter which this fat will make is found by dividing the remainder by 0.85. The result thus found is the amount of butter containing 85 per cent. of fat that is made from 100 pounds of milk. To illustrate by example, we take milk which contains 4 per cent. of fat. From this subtract 0.16 pound, the amount of fat lost in the process of butter-making, and the remainder is 3.84 pounds, amount of fat in milk that is recovered in butter. Divide 3.84 pounds by 0.85 and we get 4.52 pounds, the amount of butter containing 85 per cent. of fat that can be made from 100 pounds of milk containing 4 per cent. of fat.

The question may be asked, "What authority have we to say that 0.16 pound of fat is lost in butter-making for 100 pounds of milk and that the butter contains 85 per cent. of fat?"

Work here and elsewhere shows that when butter is made by the most economical process, the average loss of fat is about 0.16 pound for 100 pounds of milk. Such work can be done only by the use of a first-class separator in the production of cream and by skillful manipulation of the cream in the process of churning. The average loss of fat in butter making was found to be 0.16 pound for 100 pounds of milk in the work done in connection with the World's Fair test of breeds, and this serves as the most authoritative basis we have at present. So far as our work in this investigation in comparing our animals with one another is concerned, it makes little difference what allowance we make for loss of fat, provided we have one that is uniform; but it is desirable, for the sake of comparison with other investigations, that we should have the loss as near the actual working results as we can get.

In regard to the amount of the fat in butter, we have placed it at 85 per cent., believing, from all published data, that this figure represents more nearly the composition of average butter as found in the market than does 80 per cent. of fat, the figure adopted for the World's Fair test.

The standards above given for loss of fat in butter-making and for per cent. of fat in butter we shall adhere to throughout this investigation. The work done during the past four years all goes to show that the amount of fat in milk is the sole guide in regard to the amount of butter that can be made from milk, provided our conditions of creaming, churning and working are uniform, conditions which are now largely under our control. Those who still contend that only by the churn we can accurately determine the amount of butter production must have failed to follow the results of the last four years' investigation in this country or else must have entirely failed to comprehend what those results mean. If one can not make agree the results of the churn and the results of calculation of butter yield from the amount of fat in milk, the fault lies every time with the manipulator and his methods of creaming, churning, etc. One great advantage in being able to calculate the butter yield from the amount of fat in milk depends upon the fact that we have in this a means of measuring the skill of the butter maker and his methods. We can thus tell whether the yield is as much as it should be, and in case of shortage, we can find the sources of loss.

During the first period of lactation of most of our cows, we used the deep-setting process of creaming and made butter. These results have already been published (Tenth Annual Report, pp. 300-364), and also a comparison of these results with results secured by the method of calculation (Eleventh Annual Report, pp. 467-469).

In connection with this study of the comparison of different breeds of dairy cows we shall consider the following subjects:

1. Per cent. of fat in milk.
2. Amount of milk-fat produced.
3. Amount of butter produced.
4. Amount of butter made from 100 pounds of milk.
5. Amount of milk required to make one pound of butter.

6. Cost of one pound of milk-fat.
7. Cost of one pound of butter.
8. Money value of butter produced.
9. Profit derived from making and selling butter.
10. Amount of cream produced.
11. Amount of milk required to make one pound of cream.
12. Cost of one quart and one pound of cream.
13. Money value of cream produced.
14. Profit derived from selling cream.
15. General summary.

#### 1. PER CENT. OF FAT IN MILK.

The table immediately following gives the average per cent. of fat in milk of each cow for each period of lactation.

TABLE A—SHOWING PER CENT. OF FAT IN MILK.

Breed.	NAME OF COW.	PERIOD OF LACTATION.			
		First.	Second.	Third.	Fourth.
		Per cent.	Per cent.	Per cent.	Per cent.
American Holderness.	Maggie 6th .....	3.49	8.72	8.92	.....
American Holderness.	Nora .....	3.72	.....	.....	.....
Ayrshire.	Junietta Peerless .....	.....	3.20	3.48	.....
Ayrshire.	Manton Belle .....	3.86	3.67	3.59	3.45
Ayrshire.	Miss Flow 5th .....	4.24	3.44	3.56	3.88
Ayrshire.	Queen Duchess .....	3.87	3.66	.....	.....
Devon.	Artalia .....	4.88	.....	.....	.....
Devon.	Genevieve's Gift .....	4.75	5.28	.....	.....
Devon.	Ione .....	4.80	4.50	.....	.....
Guernsey.	Madame Select .....	.....	6.18	.....	.....
Guernsey.	Oriole .....	5.02	5.42	.....	.....
Guernsey.	Rosetta Ford .....	4.97	5.73	.....	.....
Guernsey.	Stella Select .....	4.51	.....	.....	.....
Holstein-Friesian	Beauty Pledge .....	.....	3.77	.....	.....
Holstein-Friesian	Eel 2d .....	3.85	.....	.....	.....
Holstein-Friesian	Netherland Constance .....	2.98	.....	.....	.....
Holstein-Friesian	Ruth .....	2.88	.....	.....	.....
Jersey.	Albert's Carol .....	5.17	5.85	.....	.....
Jersey.	Barbara Allen .....	5.81	4.96	5.41	.....
Jersey.	Countess Flavia .....	5.75	5.82	6.09	6.09
Jersey.	Gilderbloom .....	5.65	.....	5.45	.....
Shorthorn	Betsey 10th .....	4.28	4.56	.....	.....

TABLE B — SHOWING AVERAGE PER CENT. OF FAT IN MILK OF DIFFERENT BREEDS.

BREED.	FIRST PERIOD OF LACTATION.		SECOND PERIOD OF LACTATION.		THIRD PERIOD OF LACTATION.		FOURTH PERIOD OF LACTATION.		Average per cent. of fat of all periods of lactation.
	Number of cows.	Per cent. of fat.	Number of cows.	Per cent. of fat.	Number of cows.	Per cent. of fat.	Number of cows.	Per cent. of fat.	
American Holderness.....	3	3.62	1	3.72	1	3.92	.....	.....	3.73
Ayrshire.....	3	3.79	4	3.49	3	3.52	2	3.64	3.60
Devon.....	3	4.43	2	4.86	.....	.....	.....	.....	4.60
Guernsey.....	3	4.83	3	5.73	.....	.....	.....	.....	5.30
Holstein-Friesian.....	3	3.32	1	3.77	.....	.....	.....	.....	3.36
Jersey.....	4	5.47	3	5.53	3	5.62	1	6.09	5.60
Shorthorn.....	1	4.28	1	4.56	.....	.....	.....	.....	4.44

TABLE C—SHOWING SUMMARY OF AVERAGE PER CENT. OF FAT  
IN MILK.

BREED.	Number of cows.	Total number of periods of lactation.	Average per cent. of fat in milk.	Relative proportion of fat in milk.
			Pounds.	
Holstein-Friesian .....	4	4	3.36	100
Ayrshire .....	4	12	3.60	107
American Holderness .....	2	4	3.73	111
Shorthorn .....	1	2	4.44	132
Devon .....	3	5	4.60	137
Guernsey .....	4	6	5.30	160
Jersey .....	4	11	5.60	167

2. AMOUNT OF MILK-FAT PRODUCED.  
TABLE A—SHOWING POUNDS OF MILK-FAT PRODUCED.

Breed.	NAME OF COW.	PERIOD OF LACTATION.			
		First.	Second.	Third.	Fourth.
		Pounds.	Pounds.	Pounds.	Pounds.
American Holderness.	Maggie 6th.	164.1	237.4	231.4	.....
American Holderness.	Nora.	239.5	.....	.....	.....
Ayrshire.	Junietta Peerless.	.....	233.4	304.4	.....
Ayrshire.	Manton Belle.	210.3	233.0	232.5	266.7
Ayrshire.	Miss Flow 5th.	217.3	176.0	231.4	236.3
Ayrshire.	Queen Duchess.	270.8	266.7	.....	.....
Devon.	Artalia.	217.1	.....	.....	.....
Devon.	Genevieve's Gift.	145.0	209.7	.....	.....
Devon.	Ione.	169.8	175.0	.....	.....
Guernsey.	Madame Select.	.....	232.4	.....	.....
Guernsey.	Ortolo.	261.4	336.1	.....	.....
Guernsey.	Rosette Ford.	241.8	350.4	.....	.....
Guernsey.	Stella Select.	240.7	.....	.....	.....
Holstein-Friesian.	Beauty Pledge.	.....	332.8	.....	.....
Holstein-Friesian.	Eel 2d.	331.7	.....	.....	.....
Holstein-Friesian.	Netherland Constance.	277.1	.....	.....	.....
Holstein-Friesian.	Ruth.	183.7	.....	.....	.....
Jersey.	Albert's Carol.	244.2	256.4	.....	.....
Jersey.	Barbara Allen.	245.3	256.8	347.2	.....
Jersey.	Countess Flavia.	294.4	292.2	285.4	347.8
Jersey.	Gliderbloom.	226.1	.....	307.8	.....
Shorthorn.	Betsey 10th.	214.7	323.3	.....	.....

TABLE B—SHOWING AVERAGE AMOUNT OF MILK-FAT PRODUCED BY DIFFERENT BREEDS.

BREED.	FIRST PERIOD OF LACTATION.		SECOND PERIOD OF LACTATION.		THIRD PERIOD OF LACTATION.		FOURTH PERIOD OF LACTATION.		Average pounds of milk-fat of all periods of lactation.
	Number of cows.	Pounds of milk-fat.	Number of cows.	Pounds of milk-fat.	Number of cows.	Pounds of milk-fat.	Number of cows.	Pounds of milk-fat.	
American Holderness.....	2	196.8	1	227.4	1	231.4	.....	.....	213.1
Ayrshire.....	3	232.8	4	227.0	3	276.1	2	251.5	244.8
Devon .....	3	177.3	2	192.4	.....	.....	.....	.....	183.3
Guernsey .....	3	248.0	3	323.0	.....	.....	.....	.....	265.5
Holstein-Friesian .....	3	247.2	1	322.8	.....	.....	.....	.....	266.1
Jersey .....	4	252.5	3	268.5	3	313.5	1	347.8	282.1
Shorthorn .....	1	214.7	1	323.3	.....	.....	.....	.....	269.0

TABLE C—SHOWING SUMMARY OF AVERAGE AMOUNT OF MILK-FAT PRODUCED.

BREED.	Number of cows.	Total number of periods of lactation.	Average amount of milk-fat produced per cow.	Relative amount of milk-fat produced.
			Pounds.	
Devon .....	3	5	183.3	100
American Holderness .....	2	4	213.1	116
Ayrshire .....	4	12	244.8	134
Holstein-Friesian .....	4	4	266.1	145
Shorthorn .....	1	2	269.0	147
Jersey .....	4	11	282.1	154
Guernsey .....	4	6	285.5	156

3. AMOUNT OF BUTTER PRODUCED.  
TABLE A—SHOWING POUNDS OF BUTTER (CONTAINING 85 PER CENT. FAT) PRODUCED.

Breed.	NAME OF COW.	PERIOD OF LACTATION.			
		First.	Second.	Third.	Fourth.
		Pounds.	Pounds.	Pounds.	Pounds.
American Holderness	Maggie 6th	184.3	256.0	261.0	299.0
American Holderness	Nora	258.4			266.5
Ayrshire	Junietta Peerless		261.0	341.8	
Ayrshire	Manton Belle	235.7	260.6	338.3	
Ayrshire	Miss Flow 5th	246.0	197.4	360.3	
Ayrshire	Queen Duchess	305.5	300.6		
Devon	Artalia	246.0			
Devon	Genevieve's Gift	164.7	238.8		
Devon	Lone	192.4	200.0		
Guernsey	Madame Select.		335.0		
Guernsey	Oriole	297.5	372.2		
Guernsey	Rosette Ford	275.4	400.5		
Guernsey	Stella Select.	273.0			
Holstein-Friesian	Beauty Pledge		363.5		
Holstein-Friesian	Eael 2d.	317.7			
Holstein-Friesian	Netherland Constance	308.2			
Holstein-Friesian	Ruth	202.8			
Jersey	Albert's Carol	278.5	298.0		
Jersey	Barbara Allen	280.0	292.2	396.5	
Jersey	Countess Flavia	337.0	334.1	327.0	398.7
Jersey	Gilderbloom	266.4		351.3	
Shorthorn	Betsy 10th	243.3	367.0		

TABLE B—SHOWING AVERAGE AMOUNT OF BUTTER PRODUCED BY DIFFERENT BREEDS.

BREED.	FIRST PERIOD OF LACTATION.		SECOND PERIOD OF LACTATION.		THIRD PERIOD OF LACTATION.		FOURTH PERIOD OF LACTATION.		Average pounds of butter of all periods of lactation.
	Number of cows.	Pounds of butter.	Number of cows.	Pounds of butter.	Number of cows.	Pounds of butter.	Number of cows.	Pounds of butter.	
American Holderness. ....	2	231.3	1	256.0	1	261.0	.....	.....	239.9
Ayrshire .....	3	262.4	4	254.9	3	310.1	2	282.7	275.2
Devon .....	3	201.0	2	219.4	.....	.....	.....	.....	208.4
Guernsey .....	3	282.0	3	369.2	.....	.....	.....	.....	325.6
Holstein-Friesian .....	3	276.2	1	363.5	.....	.....	.....	.....	298.1
Jersey .....	4	288.5	3	306.4	3	358.2	1	398.7	322.4
Shorthorn .....	1	243.3	1	367.0	.....	.....	.....	.....	305.1

TABLE C — SHOWING SUMMARY OF AVERAGE OF BUTTER PRODUCED.

BREED.	Number of cows.	Total number of periods of lactation.	Average amount of butter produced per cow.	Relative amount of butter produced.
			Pounds.	
Devon .....	2	5	208.4	100
American Holderness .....	3	4	239.9	115
Ayrshire .....	4	12	275.2	132
Holstein-Friesian .....	4	4	298.1	143
Shorthorn .....	1	2	305.1	146
Jersey .....	4	11	322.4	154
Guernsey .....	4	6	325.6	156

4. AMOUNT OF BUTTER MADE FROM 100 POUNDS OF MILK.  
TABLE A—SHOWING POUNDS OF BUTTER MADE FROM 100 POUNDS OF MILK.

Breed.	NAME OF COW.	PERIOD OF LACTATION.			
		First.	Second.	Third.	Fourth.
		Pounds.	Pounds.	Pounds.	Pounds.
American Holderness.....	Maggie 6th.....	3.92	4.19	4.43	.....
American Holderness.....	Nora.....	4.19	.....	.....	.....
Ayrshire.....	Junietta Peerless.....	.....	3.58	3.85	.....
Ayrshire.....	Manton Belle.....	3.76	4.13	4.00	3.87
Ayrshire.....	Miss Flow 5th.....	4.80	3.86	4.00	4.88
Ayrshire.....	Queen Duchess.....	4.87	4.13	.....	.....
Devon.....	Artalia.....	4.90	.....	.....	.....
Devon.....	Genevie's Gift.....	5.40	5.96	.....	.....
Devon.....	Ione.....	4.87	5.10	.....	.....
Guernsey.....	Madame Select.....	.....	7.02	.....	.....
Guernsey.....	Oriole.....	5.72	6.19	.....	.....
Guernsey.....	Rosette Ford.....	5.66	6.55	.....	.....
Guernsey.....	Stella Select.....	5.12	.....	.....	.....
Holstein-Friesian.....	Beauty Pledge.....	.....	4.25	.....	.....
Holstein-Friesian.....	Esel 2d.....	4.34	.....	.....	.....
Holstein-Friesian.....	Netherland Constance.....	3.26	.....	.....	.....
Holstein-Friesian.....	Ruth.....	3.20	.....	.....	.....
Jersey.....	Albert's Carol.....	5.89	6.70	.....	.....
Jersey.....	Barbara Allen.....	6.06	5.65	6.18	.....
Jersey.....	Countess Flavia.....	6.58	6.66	6.98	6.98
Jersey.....	Gilderbloom.....	6.46	.....	6.22	.....
Shorthorn.....	Betsy 10th.....	4.85	5.18	.....	.....

TABLE B—SHOWING AVERAGE AMOUNT OF BUTTER PRODUCED FROM 100 POUNDS OF MILK BY DIFFERENT BREEDS.

BREED.	FIRST PERIOD OF LACTATION.		SECOND PERIOD OF LACTATION.		THIRD PERIOD OF LACTATION.		FOURTH PERIOD OF LACTATION.		Average pounds butter from 100 pounds milk for all periods of lactation.
	Number of cows.	Pounds butter from 100 pounds milk.	Number of cows.	Pounds butter from 100 pounds milk.	Number of cows.	Pounds butter from 100 pounds milk.	Number of cows.	Pounds butter from 100 pounds milk.	
American Holderne's .....	2	4.07	1	4.19	1	4.42	.....	.....	4.20
Ayrshire .....	3	4.27	4	3.92	3	3.95	2	4.10	4.05
Devon .....	3	5.02	2	5.53	.....	.....	.....	.....	5.22
Guernsey .....	3	5.50	3	6.54	.....	.....	.....	.....	6.05
Holstein-Friesian .....	3	3.60	1	4.25	.....	.....	.....	.....	3.76
Jersey .....	4	6.25	3	6.32	.....	.....	.....	.....	6.40
Shorthorn .....	1	4.85	1	5.17	3	6.42	1	7.00	5.04

TABLE C—SHOWING SUMMARY OF AVERAGE AMOUNT OF BUTTER  
MADE FROM 100 POUNDS OF MILK.

BREED.	Number of cows	Total number of periods of lactation.	Average amount of butter made from 100 pounds of milk	Relative amount of butter made from 100 pounds of milk.
			Pounds.	
Holstein-Friesian .....	4	4	3.76	100
Ayrshire .....	4	12	4.05	108
American Holderness.....	2	4	4.20	112
Shorthorn .....	1	2	5.04	134
Devon .....	3	5	5.22	139
Guernsey .....	4	6	6.05	161
Jersey .....	4	11	6.40	170

5. AMOUNT OF MILK REQUIRED TO MAKE ONE POUND OF BUTTER.  
TABLE A.—SHOWING POUNDS OF MILK REQUIRED TO MAKE ONE POUND OF BUTTER.

Breed.	NAME OF COW.	PERIOD OF LACTATION.			
		First.	Second.	Thrid.	Fourth.
		Pounds.	Pounds.	Pounds.	Pounds.
American Holderness	Maggie 6th.	25.50	23.87	22.62	.....
American Holderness	Nora	23.87	.....	.....	.....
Ayrshire	Junietta Peerless	.....	28.00	26.00	.....
Ayrshire	Manton Belle	26.60	24.21	25.00	25.84
Ayrshire	Miss Flow 6th	20.88	25.91	25.00	22.88
Ayrshire	Queen Duchess	22.91	24.27	.....	.....
Devon	Artalia	20.41	.....	.....	.....
Devon	Genevieve's Gift	18.52	16.78	.....	.....
Devon	Ione	20.53	19.60	.....	.....
Guernsey	Madame Select	.....	14.25	.....	.....
Guernsey	Oriole	17.48	16.16	.....	.....
Guernsey	Rosette Ford	17.67	15.27	.....	.....
Guernsey	Stella Select	19.58	.....	.....	.....
Holstein-Friesian	Beauty Pledge	.....	23.58	.....	.....
Holstein-Friesian	Eael 2d	23.04	.....	.....	.....
Holstein-Friesian	Netherland Constance	30.67	.....	.....	.....
Holstein-Friesian	Ruth	31.25	.....	.....	.....
Jersey	Albert's Carol	17.00	14.90	.....	.....
Jersey	Barbara Allen	16.50	17.70	16.18	.....
Jersey	Countess Flavia	15.21	15.00	14.83	14.83
Jersey	Glider Bloom	15.50	.....	16.08	.....
Shorthorn	Betsy 10th	20.62	19.80	.....	.....

TABLE B—SHOWING AVERAGE AMOUNT OF MILK REQUIRED TO MAKE ONE POUND OF BUTTER.

BREED.	FIRST PERIOD OF LACTATION.		SECOND PERIOD OF LACTATION.		THIRD PERIOD OF LACTATION.		FOURTH PERIOD OF LACTATION.		Average pounds of milk for one pound butter of all periods of lactation.
	Number of cows.	Pounds of milk for one pound butter.	Number of cows.	Pounds of milk for one pound butter.	Number of cows.	Pounds of milk for one pound butter.	Number of cows.	Pounds of milk for one pound butter.	
American Holderness.....	2	24.55	1	23.87	1	22.62	.....	.....	23.80
Ayrshire.....	3	23.42	4	25.51	3	25.32	2	24.40	24.70
Devon.....	3	18.33	2	18.08	.....	.....	.....	.....	19.15
Guernsey.....	3	18.10	3	15.30	.....	.....	.....	.....	16.53
Holstein-Friesian.....	3	27.78	1	23.53	.....	.....	.....	.....	26.60
Jersey.....	4	16.00	3	15.82	3	15.58	1	14.33	15.63
Shorthorn.....	1	20.62	1	19.30	.....	.....	.....	.....	19.84

TABLE C—SHOWING SUMMARY OF AVERAGE AMOUNT OF MILK  
REQUIRED TO MAKE ONE POUND OF BUTTER.

BREED.	Number of cows.	Total number of periods of lactation.	Average amount of milk required to make one pound of butter.	Relative amount of milk for butter.
			Pounds.	
Jersey .....	4	11	15.63	100
Guernsey .....	4	6	16.53	106
Devon.....	3	5	19.15	122
Shorthorn .....	1	2	19.84	127
American Holderness .....	2	4	23.80	152
Ayrshire .....	4	12	24.70	158
Holstein Friesian .....	4	4	26.60	170

6. COST OF ONE POUND OF MILK-FAT.  
TABLE A—SHOWING COST OF ONE POUND OF MILK-FAT.

Breed.	NAME OF COW.	PERIOD OF LACTATION.			
		FIRST.	SECOND.	THIRD.	FOURTH.
		Cents per pound.	Cents per pound.	Cents per pound.	Cents per pound.
American Holderness	Maggie 6th	23.70	20.75	20.61	.....
American Holderness	Nora	16.43	.....	.....	.....
Ayrshire	Junietta Peerless	.....	21.80	17.31	.....
Ayrshire	Manton Belle	20.10	21.94	20.00	18.93
Ayrshire	Miss Flow 5th	22.33	22.95	21.73	21.84
Ayrshire	Queen Duches	18.10	18.44	.....	.....
Devon	Artalia	19.25	.....	.....	.....
Devon	Genevieve's Gift	19.80	18.43	.....	.....
Devon	Ione	21.40	24.00	.....	.....
Guernsey	Madame Select	.....	16.31	.....	.....
Guernsey	Ortolo	14.61	14.73	.....	.....
Guernsey	Rosette Ford	16.90	15.70	.....	.....
Guernsey	Stella Select	19.70	.....	.....	.....
Holstein-Friesian	Beauty Pledge	.....	15.45	.....	.....
Holstein-Friesian	Ezel 2d	18.70	.....	.....	.....
Holstein-Friesian	Netherland Constance	20.75	.....	.....	.....
Holstein-Friesian	Ruth	23.63	.....	.....	.....
Jersey	Albert's Carol	18.96	16.62	.....	.....
Jersey	Barbara Allen	18.00	18.77	14.75	.....
Jersey	Countess Flavia	17.00	15.44	15.33	12.96
Jersey	Gilderbloom	18.44	.....	14.07	.....
Shorthorn	Betsey 10th	20.50	15.00	.....	.....

TABLE B—SHOWING AVERAGE COST OF ONE POUND OF MILK-FAT.

BREED.	FIRST PERIOD OF LACTATION.		SECOND PERIOD OF LACTATION.		THIRD PERIOD OF LACTATION.		FOURTH PERIOD OF LACTATION.		Average cost of one pound of fat of all periods of lactation.
	Number of cows.	Cost of one pound of fat.	Number of cows.	Cost of one pound of fat.	Number of cows.	Cost of one pound of fat.	Number of cows.	Cost of one pound of fat.	
American Holderness .....	2	19.48	1	20.76	1	20.61	.....	.....	20.13
Ayrshire .....	3	20.02	4	21.10	3	19.45	2	19.77	20.15
Devon .....	3	20.10	2	20.97	.....	.....	.....	.....	20.47
Guernsey .....	3	17.00	3	15.48	.....	.....	.....	.....	16.14
Holstein-Friesian .....	3	20.68	1	15.35	.....	.....	.....	.....	19.06
Jersey .....	4	18.02	3	16.87	3	14.60	1	12.96	16.12
Shorthorn .....	1	20.50	1	15.00	.....	.....	.....	.....	17.18

TABLE C—SHOWING SUMMARY OF AVERAGE COST OF MILK-FAT.

BREED.	Number of cows	Total number of periods of lactation.	Average cost of milk-fat per pound.	Relative cost of milk-fat.
			Cents.	
Jersey .....	4	11	16.12	100
Guernsey .....	4	6	16.14	100.1
Shorthorn .....	1	2	16.18	107
Holstein-Friesian .....	4	4	19.06	118
American Holderness .....	2	4	20.13	124.9
Ayrshire .....	4	12	20.15	125
Devon .....	3	5	20.47	127

7. COST OF ONE POUND OF BUTTER.  
TABLE A—SHOWING COST OF ONE POUND OF BUTTER.

Breed.	NAME OF COW.	PERIOD OF LACTATION.			
		First.	Second.	Third.	Fourth.
American Holderness.	Maggie 6th	Cents. 21.13	Cents. 18.44	Cents. 19.50	Cents. 19.86
American Holderness.	Nora	14.63			
Ayrshire	Junietta Peerless		19.50	15.38	
Ayrshire	Manton Belle	17.95	19.58	17.80	16.00
Ayrshire	Miss Flow 5th	19.70	20.48	19.32	19.86
Ayrshire	Queen Duchess	16.04	16.40		
Devon	Artalia	17.00			
Devon	Genevie's Gift	17.42	16.18		
Devon	Ione	18.92	21.00		
Guernsey	Madame Select		14.15		
Guernsey	Oriole	12.84	12.90		
Guernsey	Rosette Ford	14.85	18.78		
Guernsey	Stella Select	17.36			
Holstein-Friesian	Beauty Pledge		18.68		
Holstein-Friesian	Esel 2d	16.68			
Holstein-Friesian	Netherland Constance	18.65			
Holstein-Friesian	Ruth	21.26			
Jersey	Albert's Carol		14.54		
Jersey	Barbara Allen	16.62	16.50	12.66	
Jersey	Countess Flavia	15.75	18.50	18.42	11.80
Jersey	Gilderbloom	16.14		12.38	
Shorthorn	Betsey 10th	18.08	13.20		

TABLE B—SHOWING AVERAGE COST OF ONE POUND OF BUTTER FOR DIFFERENT BREEDS.

BREED.	FIRST PERIOD OF LACTATION.		SECOND PERIOD OF LACTATION.		THIRD PERIOD OF LACTATION.		FOURTH PERIOD OF LACTATION.		Average cost of one pound of butter of all periods of lactation.
	Number of cows.	Cost of one pound of butter.	Number of cows.	Cost of one pound of butter.	Number of cows.	Cost of one pound of butter.	Number of cows.	Cost of one pound of butter.	
American Holderness.....	2	17.32	1	18.44	1	19.50	.....	.....	17.90
Ayrshire.....	3	17.76	4	18.78	3	17.32	2	17.60	17.92
Devon.....	3	17.73	2	18.40	.....	.....	.....	.....	18.00
Guernsey.....	3	14.95	3	13.54	.....	.....	.....	.....	14.15
Holstein-Friesian.....	3	18.50	1	13.63	.....	.....	.....	.....	17.02
Jersey.....	4	15.77	3	14.78	3	12.78	1	11.30	14.11
Shorthorn.....	1	18.08	1	13.20	.....	.....	.....	.....	15.15

TABLE C—SHOWING SUMMARY OF AVERAGE COST OF BUTTER PER POUND.

BREED.	Number of cows.	Total number of periods of lactation.	Average cost of one pound of butter.	Relative cost of one pound of butter.
			Cents.	
Jersey .....	4	11	14.11	100
Guernsey .....	4	6	14.15	100.2
Shorthorn .....	1	2	15.15	107
Holstein-Friesian .....	4	4	17.02	120
American Holderness .....	2	4	17.90	126.9
Ayrshire .....	4	12	17.92	127
Devon .....	3	5	18.00	128

## 8. MONEY VALUE OF BUTTER PRODUCED.

In calculating the money value of butter produced, we base our calculations on the average value of 25 cents per pound for butter, taking the year round.

TABLE A — SHOWING MONEY VALUE OF BUTTER PRODUCED BY DIFFERENT COWS.

Breed.	NAME OF COW.	PERIOD OF LACTATION.			
		First.	Second.	Third.	Fourth.
American Holderness	Maggie 6th.	\$46 05	\$64 00	\$65 25	.....
American Holderness	Nora	64 60	.....	.....	.....
Ayrshire	Junieta Peerless	.....	65 35	85 45	.....
Ayrshire	Manton Belle	58 98	65 15	82 08	\$74 75
Ayrshire	Miss Flow 5th	61 50	49 35	65 08	86 68
Ayrshire	Queen Duchess	76 38	75 15	.....	.....
Devon	Artalia	61 50	.....	.....	.....
Devon	Genevie's Gift	41 18	59 70	.....	.....
Devon	Lone	48 10	50 00	.....	.....
Guernsey	Madame Select	.....	88 75	.....	.....
Guernsey	Oriole	74 88	98 05	.....	.....
Guernsey	Rosette Ford	68 85	100 18	.....	.....
Guernsey	Stella Select	68 26	.....	.....	.....
Holstein-Friesian	Beauty Pledge	.....	90 88	.....	.....
Holstein-Friesian	Esel 2d.	79 48	.....	.....	.....
Holstein-Friesian	Netherland Constance	77 05	.....	.....	.....
Holstein-Friesian	Ruth	50 70	.....	.....	.....
Jersey	Albert's Carol	69 68	73 25	.....	.....
Jersey	Barbara Allen	70 00	73 05	99 18	.....
Jersey	Countess Flavia	84 25	88 53	81 75	99 69
Jersey	Gilderbloom	64 60	.....	87 80	.....
Shorthorn	Betsy 10th	60 88	91 75	.....	.....

TABLE B—SHOWING AVERAGE MONEY VALUE OF BUTTER PRODUCED.

BREED.	FIRST PERIOD OF LACTATION.		SECOND PERIOD OF LACTATION.		THIRD PERIOD OF LACTATION.		FOURTH PERIOD OF LACTATION.		Money value of butter, average of all periods of lactation.
	Number of cows	Money value of butter.	Number of cows.	Money value of butter.	Number of cows.	Money value of butter.	Number of cows.	Money value of butter.	
American Holderness.....	2	\$55 33	1	\$64 00	1	\$65 25	.....	.....	\$59 98
Ayrshire.....	3	65 60	4	63 73	3	77 53	2	\$70 68	68 80
Devon.....	3	50 25	2	54 85	.....	.....	.....	.....	52 10
Guernsey.....	3	70 50	3	92 80	.....	.....	.....	.....	81 40
Holstein-Friesian.....	3	69 05	1	90 88	.....	.....	.....	.....	74 53
Jersey.....	4	72 13	3	76 60	3	89 55	1	99 68	80 60
Shorthorn.....	1	60 83	1	91 75	.....	.....	.....	.....	76 28

**TABLE C—SHOWING SUMMARY OF AVERAGE MONEY VALUE OF BUTTER PRODUCED PER COW.**

BREED.	Number of cows.	Total number of periods of lactation.	Average money value of butter produced per cow for one period of lactation.	Relative money value of butter produced.
Devon.....	3	5	\$52 10	100
American Holderness.....	2	4	59 98	115
Ayrshire.....	4	12	68 80	132
Holstein Friesian.....	4	4	74 53	143
Shorthorn.....	1	2	76 28	146
Jersey.....	4	11	80 60	155
Guernsey.....	4	6	81 40	156

### 9. PROFIT DERIVED FROM MAKING AND SELLING BUTTER.

The value of fertilizing materials contained in butter is very minute, so that we need to make no deduction from profits for this. Butter-making has the advantage over milk-selling of retaining the fertilizing value of the milk on the farm and also the feeding value of the skim-milk and buttermilk. The profits presented below are obtained by subtracting the cost of food from the money-value of butter produced.

TABLE A — SHOWING AMOUNT OF PROFIT DERIVED FROM BUTTER-MAKING.

Breed.	NAME OF COW.	PERIOD OF LACTATION.			
		First.	Second.	Third.	Fourth.
American Holderness.	Maggie 6th.	\$7 15	\$16 80	\$17 55	.....
American Holderness.	Nora.	26 82	.....	.....	.....
Ayrshire.	Junietta Peerless.	.....	14 35	33 05	.....
Ayrshire.	Manon Belle.	16 63	14 25	23 03	\$26 98
Ayrshire.	Miss Flow 6th.	13 00	8 95	14 78	15 08
Ayrshire.	Queen Duchess.	27 38	25 85	.....	.....
Devon.	Artalia.	19 70	.....	.....	.....
Devon.	Genevie's Gift.	12 48	21 00	.....	.....
Devon.	Ione.	11 70	8 00	.....	.....
Guernsey.	Madame Select.	.....	36 35	.....	.....
Guernsey.	Oriole.	36 18	45 05	.....	.....
Guernsey.	Rosette Ford.	27 95	45 13	.....	.....
Guernsey.	Stella Select.	20 86	.....	.....	.....
Holstein-Friesian.	Beauty Pledge.	.....	41 83	.....	.....
Holstein-Friesian.	Eel 2d.	26 73	.....	.....	.....
Holstein-Friesian.	Netherland Constance.	19 55	.....	.....	.....
Holstein-Friesian.	Ruth.	7 53	.....	.....	.....
Jersey.	Albert's Carol.	28 33	30 64	.....	.....
Jersey.	Barbara Allen.	25 90	24 85	48 98	.....
Jersey.	Countess Flavia.	34 25	38 43	37 85	54 61
Jersey.	Gilderbloom.	22 90	.....	44 50	.....
Shorthorn.	Betsey 10th.	16 88	43 80	.....	.....

TABLE B—SHOWING AVERAGE PROFIT PER COW DERIVED FROM SELLING BUTTER.

BREED.	FIRST PERIOD OF LACTATION.		SECOND PERIOD OF LACTATION.		THIRD PERIOD OF LACTATION.		FOURTH PERIOD OF LACTATION.		Average profit per cow of all periods of lactation.
	Number of cows.	Profit per cow.	Number of cows.	Profit per cow.	Number of cows.	Profit per cow.	Number of cows.	Profit per cow.	
American Holderness .....	2	\$16 99	1	\$16 80	1	\$17 55	.....	.....	\$17 08
Ayrshire .....	3	19 00	4	15 86	3	23 83	2	\$20 97	19 48
Devon .....	3	14 62	2	14 50	.....	.....	.....	.....	14 58
Guernsey .....	3	28 33	3	42 17	.....	.....	.....	.....	35 25
Holstein-Friesian .....	3	17 93	1	41 33	.....	.....	.....	.....	23 80
Jersey .....	4	26 63	3	31 30	3	43 75	1	54 61	35 11
Shorthorn .....	1	16 83	1	43 30	.....	.....	.....	.....	30 06

TABLE C --SHOWING SUMMARY OF AVERAGE PROFIT PER COW  
FROM SELLING BUTTER.

BREED.	Number of cows	Total number of periods of lactation.	Average amount of profit per cow from selling butter for one period of lactation.	Relative profit derived from selling butter.
Devon .....	3	5	\$14 58	100
American Holderness.....	2	4	17 08	117
Ayrshire .....	4	12	19 48	134
Holstein-Friesian.....	4	4	23 80	163
Shorthorn.....	1	2	30 06	206
Jersey .....	4	11	35 11	241
Guernsey .....	4	6	35 25	243

## 10. AMOUNT OF CREAM PRODUCED.

In order to have the conditions uniform for all cows, it is necessary to take a standard for cream and to calculate the amount of such standard cream produced by each cow. For our purpose, we adopt, as a standard, cream containing 20 per cent. of fat. Commercial cream is not likely to average any higher than this in fat but is probably lower. On this basis we shall have for different animals amounts of cream proportional to the amount of fat in milk. In the tables below, we give the amount of cream, containing 20 per cent. of fat, produced by the different cows for each period of lactation.

For calculating pounds into quarts, one quart of such cream weighs approximately 2.11 pounds.

TABLE A — SHOWING POUNDS AND QUARTS OF CREAM PRODUCED.

Breed.	NAME OF COW.	PERIOD OF LACTATION.							
		FIRST.		SECOND.		THIRD.		FOURTH.	
		Pounds.	Quarts.	Pounds.	Quarts.	Pounds.	Quarts.	Pounds.	Quarts.
American Holderness	Maggie 6th	820.5	888.9	1187	588.9	1157.1	548.4	.....	.....
American Holderness	Nora	1147.5	543.8	.....	.....	.....	.....	.....	.....
Ayrshire	Junietta Peerless	.....	.....	1167	553.1	1522	731.8	.....	.....
Ayrshire	Manton Belle	1051.5	486.3	1160	549.8	1462.5	693.2	1333.5	693
Ayrshire	Miss Flow 5th	1086.5	514.9	890	417.1	1157	548.8	1181.5	560
Ayrshire	Queen Duchess	1354	641.7	1333.5	632	.....	.....	.....	.....
Devon	Artalia	1085.5	514.5	.....	.....	.....	.....	.....	.....
Devon	Genevieve's Gift	725	343.6	1048.5	406.9	.....	.....	.....	.....
Devon	Lone	849	402.4	875	414.7	.....	.....	.....	.....
Guernsey	Madame Select	.....	.....	1462	692.9	.....	.....	.....	.....
Guernsey	Oriole	1807	619.4	1680.5	772.7	.....	.....	.....	.....
Guernsey	Rosette Ford	1209.5	573.3	1760.2	829.5	.....	.....	.....	.....
Guernsey	Stella Select	1208.5	570.4	.....	.....	.....	.....	.....	.....
Holstein-Friesian	Beauty Pledge	.....	.....	1614	765	.....	.....	.....	.....
Holstein-Friesian	Esel 2d	1408.5	667.5	.....	.....	.....	.....	.....	.....
Holstein-Friesian	Netherland Constance	1385.5	656.6	.....	.....	.....	.....	.....	.....
Holstein-Friesian	Ruth	918.5	433.9	.....	.....	.....	.....	.....	.....
Jersey	Albert's Carol	1221	678.7	1982	607.6	.....	.....	.....	.....
Jersey	Barbara Allen	1226.5	581.8	1384	608.5	1796	822.8	.....	.....
Jersey	Countess Flavia	1472	697.6	1461	692.4	1427	676.8	1789	824.3
Jersey	Gilderbloom	1180.5	555.8	.....	.....	1539	729.4	.....	.....
Shorthorn	Betsy 10th	1078.5	508.8	1616.5	766.1	.....	.....	.....	.....

TABLE B—SHOWING AVERAGE AMOUNT OF CREAM PRODUCED PER COW.

BREED.	FIRST PERIOD OF LACTATION.		SECOND PERIOD OF LACTATION.		THIRD PERIOD OF LACTATION.		FOURTH PERIOD OF LACTATION.		AVERAGE OF ALL PERIODS OF LACTATION.	
	Pounds.	Quarts.	Pounds.	Quarts.	Pounds.	Quarts.	Pounds.	Quarts.	Pounds.	Quarts.
American Holderness.	984	466.3	1137	538.9	1157	548.4	.....	.....	1065.5	505
Ayrshire .....	1164	551.7	1135	537.9	1380.5	654.3	.....	596	1224	580.1
Devon .....	886.5	420.2	982	456	.....	.....	.....	.....	916.5	434.3
Guernsey .....	1240	587.7	1615	765	.....	.....	.....	.....	1427.5	676.5
Holstein-Friesian .....	1236	585.8	1614	765	.....	.....	.....	.....	1330.5	630.5
Jersey .....	1262.5	598.3	1342.5	636.2	1567.5	742.9	.....	824.2	1410.5	688.5
Shorthorn .....	1073.5	508.8	1616.5	766.1	.....	.....	.....	.....	1345	637.4

TABLE C—SHOWING SUMMARY OF AVERAGE AMOUNT OF CREAM PRODUCED PER COW.

BREED.	Number of cows	Total number of periods of lactation.	AVERAGE AMOUNT OF CREAM PRODUCED PER COW FOR ONE PERIOD OF LACTATION.		Relative amount of cream produced.
			Pounds.	Quarts.	
Devon .....	3	5	916.5	434.3	100
American Holderness....	2	4	1065.5	505	116
Ayrshire .....	4	12	1224	580.1	134
Holstein-Friesian .....	4	4	1330.5	630.6	145
Shorthorn .....	1	2	1845	637.4	147
Jersey .....	4	11	1410.5	664.5	154
Guernsey .....	4	6	1427.5	676.5	156

## 11. AMOUNT OF MILK REQUIRED TO PRODUCE ONE POUND OF CREAM.

TABLE A — SHOWING AMOUNT OF MILK REQUIRED TO PRODUCE ONE POUND OF CREAM.

Breed.	NAME OF COW.	PERIOD OF LACTATION.			
		First.	Second.	Third.	Fourth.
		Pounds.	Pounds.	Pounds.	Pounds.
American Holderness.	Maggie 6th.	5.73	5.98	5.10	.....
American Holderness.	Nora.	5.87	.....	.....	.....
Ayrshire.	Junietta Peerless	.....	6.25	5.88	.....
Ayrshire.	Manton Belle.	5.99	5.44	5.56	5.80
Ayrshire.	Miss Flow 6th.	4.71	5.81	5.63	5.15
Ayrshire.	Queen Duchess	5.16	5.47	.....	.....
Devon.	Artalia.	4.63	.....	.....	.....
Devon.	Genevieve's Gift.	4.80	3.89	.....	.....
Devon.	Lone.	4.65	4.46	.....	.....
Guernsey.	Madame Select	.....	3.96	.....	.....
Guernsey.	Oriole.	3.98	3.69	.....	.....
Guernsey.	Rosetta Ford	4.03	3.50	.....	.....
Guernsey.	Stella Select.	4.43	.....	.....	.....
Holstein-Friesian.	Beauty Pledge.	.....	5.80	.....	.....
Holstein-Friesian.	Eel 2d.	5.20	.....	.....	.....
Holstein-Friesian.	Netherland Constance	6.83	.....	.....	.....
Holstein-Friesian.	Ruth.	6.94	.....	.....	.....
Jersey.	Albert's Carol	3.87	3.43	.....	.....
Jersey.	Barbara Allen.	3.76	4.08	3.70	.....
Jersey.	Countess Flavia	3.49	3.44	3.29	3.29
Jersey.	Gliderbloom.	3.54	.....	3.60	.....
Shorthorn.	Betsy 10th.	4.67	4.39	.....	.....

TABLE B—SHOWING AVERAGE AMOUNT OF MILK REQUIRED TO  
MAKE ONE POUND OF CREAM.

BREED.	First period of lactation.	Second period of lactation.	Third period of lactation.	Fourth period of lactation.	Average of all periods of lac- tation.
	Pounds.	Pounds.	Pounds.	Pounds.	Pounds.
American Holderness .....	5.52	5.38	5.10	.....	5.37
Ayrshire .....	5.28	5.73	5.70	5.50	5.58
Devon .....	4.51	4.11	.....	.....	4.35
Guernsey .....	4.14	3.49	.....	.....	3.80
Holstein-Friesian .....	6.23	5.80	.....	.....	5.95
Jersey .....	3.66	3.64	3.56	3.29	3.60
Shorthorn .....	4.67	4.39	.....	.....	4.50

TABLE C—SHOWING SUMMARY OF AVERAGE AMOUNT OF MILK  
FOR ONE POUND OF CREAM.

BREED.	Number of cows.	Total number of periods of lac- tation.	Average amount milk required to make one pound of cream.	Relative amount of milk re- quired to make cream.
Jersey .....	4	11	3.60	100
Guernsey .....	4	6	3.80	106
Devon .....	3	5	4.35	121
Shorthorn .....	1	2	4.50	125
American Holderness .....	2	4	5.37	149
Ayrshire .....	4	12	5.58	155
Holstein-Friesian .....	4	4	5.95	165

## 12. COST OF CREAM BY THE POUND AND QUART.

TABLE A — SHOWING FOOD COST OF ONE POUND AND OF ONE QUART OF CREAM.

Breed.	NAME OF COW.	PERIOD OF LACTATION.							
		FIRST.		SECOND.		THIRD.		FOURTH.	
		Cents per pound.	Cents per quart.	Cents per pound.	Cents per quart.	Cents per pound.	Cents per quart.	Cents per pound.	Cents per quart.
American Holderness.....	Maggie 6th.....	4.74	10.00	4.15	8.76	4.12	8.69	.....	.....
American Holderness.....	Nora.....	3.29	6.94	.....	.....	.....	.....	.....	.....
Ayrshire.....	Junietta Peerless.....	.....	.....	4.86	9.20	8.44	7.37	.....	.....
Ayrshire.....	Manton Belle.....	4.03	8.49	4.39	9.26	4.00	8.44	.....	7.55
Ayrshire.....	Miss Flow 5th. ....	4.47	9.43	4.60	9.70	4.85	9.17	.....	9.23
Ayrshire.....	Queen Duchess.....	3.63	7.64	3.70	7.90	.....	.....	.....	.....
Devon.....	Artalia.....	3.85	8.12	.....	.....	.....	.....	.....	.....
Devon.....	Genevieve's Gift.....	3.96	8.86	3.69	7.79	.....	.....	.....	.....
Devon.....	Ione.....	4.29	9.05	4.80	10.18	.....	.....	.....	.....
Guernsey.....	Madame Select.....	.....	.....	3.24	6.84	.....	.....	.....	.....
Guernsey.....	Ortolo.....	3.93	6.26	2.94	6.20	.....	.....	.....	.....
Guernsey.....	Rosette Ford.....	3.85	7.13	3.14	6.63	.....	.....	.....	.....
Guernsey.....	Stella Select.....	3.94	8.31	.....	.....	.....	.....	.....	.....
Holstein-Friesian.....	Beauty Pledge.....	.....	.....	3.07	6.43	.....	.....	.....	.....
Holstein-Friesian.....	Feel 2d.....	3.74	7.89	.....	.....	.....	.....	.....	.....
Holstein-Friesian.....	Netherland Constance.....	4.15	8.76	.....	.....	.....	.....	.....	.....
Holstein-Friesian.....	Ruth.....	4.78	9.98	.....	.....	.....	.....	.....	.....
Jersey.....	Albert's Carol.....	3.79	8.00	3.33	7.00	.....	.....	.....	.....
Jersey.....	Barbara Allen.....	3.60	7.60	3.76	7.98	2.90	6.12	.....	.....
Jersey.....	Countess Flavia.....	3.40	7.17	3.09	6.53	3.08	6.49	.....	5.49
Jersey.....	Gilderbloom.....	3.69	7.79	.....	.....	2.81	5.93	.....	.....
Shorthorn.....	Betsy 10th.....	4.10	8.65	3.00	6.88	.....	.....	.....	.....

TABLE B — SHOWING AVERAGE COST OF CREAM PER POUND AND QUART.

BREED.	FIRST PERIOD OF LACTATION.		SECOND PERIOD OF LACTATION.		THIRD PERIOD OF LACTATION.		FOURTH PERIOD OF LACTATION.		AVERAGE OF ALL PERIODS OF LACTATION.	
	Cents per pound.	Cents per quart.	Cents per pound.	Cents per quart.	Cents per pound.	Cents per quart.	Cents per pound.	Cents per quart.	Cents per pound.	Cents per quart.
American Holderness.	3.90	8.23	4.15	8.76	4.12	8.69	.....	.....	4.03	8.50
Ayrshire .....	4.00	8.44	4.22	8.90	3.90	8.23	3.95	8.33	4.03	8.50
Devon .....	4.02	8.48	4.20	8.86	.....	.....	.....	.....	4.09	8.63
Guernsey .....	3.40	7.17	3.10	6.54	.....	.....	.....	.....	3.23	6.82
Holstein-Friesian.....	4.14	8.74	3.07	6.48	.....	.....	.....	.....	3.81	8.04
Jersey .....	3.60	7.60	3.37	7.11	2.92	6.16	2.60	5.49	3.22	6.79
Shorthorn .....	4.10	8.65	3.00	6.33	.....	.....	.....	.....	3.44	7.26

TABLE C—SHOWING SUMMARY OF AVERAGE COST OF CREAM.

BREED.	Number of cows.	Number of periods of lactation.	AVERAGE COST OF CREAM.		Relative cost of cream.
			Cents per pound.	Cents per quart.	
Jersey .....	4	11	3.22	6.79	100
Guernsey .....	4	6	3.23	6.82	100.3
Shorthorn .....	1	2	3.44	7.26	107
Holstein-Friesian .....	4	4	3.81	8.04	118
American Holderness .....	2	4	4.03	8.50	125
Ayrshire .....	4	12	4.03	8.50	125
Devon .....	3	5	4.09	8.63	127

## 13. MONEY VALUE OF CREAM PRODUCED.

In calculating the money value of cream produced we place the value of cream at 20 cents per quart. When it is considered that the cream contains 20 per cent. of fat this value will not be regarded as too high.

TABLE A — SHOWING MONEY VALUE OF CREAM PRODUCED.

Breed.	NAME OF COW.	PERIOD OF LACTATION.			
		First.	Second.	Thrd.	Fourth.
American Holderness.	Maggie 6th	\$77 78	\$107 78	\$109 68	.....
American Holderness.	Nora	108 76	.....	.....	.....
Ayrshire	Junietta Peerless.	.....	110 62	144 26	.....
Ayrshire	Manton Belle.	99 66	109 96	183 64	\$126 40
Ayrshire	Miss Flow 5th.	102 98	83 43	109 66	112 00
Ayrshire	Queen Duchess.	128 84	126 40	.....	.....
Devon	Artalia.	102 90	.....	.....	.....
Devon	Genevie's Gift.	68 72	99 38	.....	.....
Devon	Ione	80 48	82 94	.....	.....
Guernsey	Madame Select.	.....	138 58	.....	.....
Guernsey	Oriole	128 88	154 54	.....	.....
Guernsey	Rosette Ford.	114 64	165 90	.....	.....
Guernsey	Stella Select.	114 08	.....	.....	.....
Holstein-Friesian	Beauty Pledge.	.....	153 50	.....	.....
Holstein-Friesian	Esel 2d	138 50	.....	.....	.....
Holstein-Friesian	Netherland Constance.	181 82	.....	.....	.....
Holstein-Friesian	Ruth.	86 58	.....	.....	.....
Jersey	Albert's Carol	115 74	121 52	.....	.....
Jersey	Barbara Allen	116 26	121 70	164 56	.....
Jersey	Countess Flavia.	489 52	138 48	135 26	164 84
Jersey	Gilderbloom	107 16	.....	145 88	.....
Shorthorn	Betsey 10th.	101 76	.....	153 23	.....

TABLE B—SHOWING AVERAGE MONEY VALUE OF CREAM PRODUCED PER COW.

BREED.	FIRST PERIOD OF LACTATION.		SECOND PERIOD OF LACTATION.		THIRD PERIOD OF LACTATION.		FOURTH PERIOD OF LACTATION.		AVERAGE OF ALL PERIODS OF LACTATION.	
	Number of cows.	Value of cream per cow.	Number of cows.	Value of cream per cow.	Number of cows.	Value of cream per cow.	Number of cows.	Value of cream per cow.	Number of cows.	Value of cream per cow.
American Holderness.	2	\$93 26	1	\$107 78	1	\$109 68	.....	.....	2	\$101 00
Ayrshire .....	3	110 34	4	107 58	3	130 86	.....	\$119 20	4	116 02
Devon .....	3	84 04	2	91 20	.....	.....	.....	.....	3	86 86
Guernsey .....	3	117 54	3	153 00	.....	.....	.....	.....	4	135 27
Holstein-Friesian .....	3	117 16	1	153 00	.....	.....	.....	.....	4	136 10
Jersey .....	4	119 66	3	127 24	.....	148 58	1	164 84	4	133 70
Shorthorn .....	1	101 76	1	153 22	.....	.....	.....	.....	1	127 48

TABLE C—SHOWING SUMMARY OF AVERAGE MONEY VALUE OF CREAM PRODUCED PER COW.

BREED.	Number of cows.	Total number of periods of lactation.	Average money value of cream produced per cow for the period of lactation.	Relative money value of cream produced.
Devon .....	3	5	\$86 86	100
American Holderness.....	2	4	101 00	116
Ayrshire .....	4	12	116 02	134
Holstein-Friesian .....	4	4	126 10	145
Shorthorn .....	1	2	127 48	147
Jersey .....	4	11	133 70	154
Guernsey .....	4	6	135 27	156

#### 14. PROFIT DERIVED FROM SELLING CREAM.

We have already seen that the amount of valuable feeding and fertilizing material sent from the farm where milk is sold is not inconsiderable. We have also seen that, when only butter is sold, these materials are kept on the farm. Now, in the case of cream, a much smaller quantity of these materials is sent away, amounting to no more than \$1.50 per year in most cases. Therefore, in calculating the profits derived from selling cream, we should consider this factor, and shall present the figures for apparent and actual profit in each case. We value the cream, less the fat, at 12½ cents per 100 pounds, since it can be purchased for this, although its actual feeding and fertilizing value is quite twice this.

TABLE A — SHOWING APPARENT AND ACTUAL PROFIT DERIVED FROM SELLING CREAM.

Breed.	NAME OF COW.	FIRST PERIOD OF LACTATION.			SECOND PERIOD OF LACTATION.			THIRD PERIOD OF LACTATION.			FOURTH PERIOD OF LACTATION.		
		Appar-ent profit.	Feed-ling and fertiliz-ing value.	Actual profit.	Appar-ent profit.	Feed-ling and fertiliz-ing value.	Actual profit.	Appar-ent profit.	Feed-ling and fertiliz-ing value.	Actual profit.	Appar-ent profit.	Feed-ling and fertiliz-ing value.	Actual profit.
American Holderness	Maggie 6th.....	\$38 88	\$0 82	\$38 06	\$30 50	\$1 14	\$30 36	\$61 98	\$1 16	\$30 82	.....	.....	.....
American Holderness	Nora.....	70 95	1 15	69 80	.....	.....	.....	.....	.....	.....	.....	.....	.....
Ayrshire	Junietta Pearties.....	.....	.....	.....	59 72	1 17	58 55	91 83	1 53	90 30	.....	.....	.....
Ayrshire	Manion Belle.....	57 26	1 05	56 21	59 63	1 18	58 45	80 24	1 47	78 78	\$73 53	\$1 24	\$77 24
Ayrshire	Miss Flow 5th.....	54 43	1 09	53 34	45 02	0 83	44 19	59 56	1 16	53 30	60 40	1 13	59 27
Ayrshire	Queen Duchess.....	79 84	1 36	77 48	77 10	1 24	75 86	.....	.....	.....	.....	.....	.....
Devon	Artalis.....	61 10	1 09	60 01	.....	.....	.....	.....	.....	.....	.....	.....	.....
Devon	Genevieve's Gift.....	40 01	0 73	39 28	40 63	1 05	39 58	.....	.....	.....	.....	.....	.....
Devon	Lone.....	44 05	0 85	43 20	40 94	0 83	40 07	.....	.....	.....	.....	.....	.....
Guernsey	Madame Select.....	.....	.....	.....	91 18	1 48	89 70	.....	.....	.....	.....	.....	.....
Guernsey	Orbale.....	55 55	1 21	54 34	105 54	1 43	104 11	.....	.....	.....	.....	.....	.....
Guernsey	Essex's Ford.....	73 24	1 21	72 03	110 30	1 75	108 55	.....	.....	.....	.....	.....	.....
Guernsey	Stella Select.....	66 65	1 30	65 35	.....	.....	.....	.....	.....	.....	.....	.....	.....
Holstein-Friesian	Beatty Pledge.....	.....	.....	.....	103 45	1 61	101 84	.....	.....	.....	.....	.....	.....
Holstein-Friesian	Evel 2d.....	50 50	1 11	49 39	.....	.....	.....	.....	.....	.....	.....	.....	.....
Holstein-Friesian	Edel 2d.....	72 83	1 25	71 58	.....	.....	.....	.....	.....	.....	.....	.....	.....
Holstein-Friesian	Netherland Comrade.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Holstein-Friesian	Ruth.....	.....	.....	.....	43 51	.....	.....	.....	.....	.....	.....	.....	.....
Jersey	Albert's Carol.....	69 44	1 28	68 16	78 91	1 28	77 63	114 56	1 73	112 83	.....	.....	.....
Jersey	Barbara Allen.....	72 15	1 25	70 90	73 50	1 43	72 07	91 36	1 43	89 94	119 77	1 74	118 03
Jersey	Courtesy Flavia.....	59 23	1 17	58 06	93 83	1 46	91 37	103 53	1 54	101 94	.....	.....	.....
Jersey	Guldbloom.....	65 46	1 13	64 33	.....	.....	.....	.....	.....	.....	.....	.....	.....
Shorthorn	B-tay 10th.....	57 76	1 08	56 68	104 77	1 68	103 15	.....	.....	.....	.....	.....	.....

TABLE B—SHOWING AVERAGE AMOUNT OF PROFIT PER COW DERIVED FROM SELLING CREAM.

BREED.	FIRST PERIOD OF LACTATION.		SECOND PERIOD OF LACTATION.		THIRD PERIOD OF LACTATION.		FOURTH PERIOD OF LACTATION.		AVERAGE OF ALL PERIODS OF LACTATION.	
	Apparent profit.	Actual profit.	Apparent profit.	Actual profit.	Apparent profit.	Actual profit.	Apparent profit.	Actual profit.	Apparent profit.	Actual profit.
American Holderness.	\$54 92	\$53 95	\$60 50	\$59 36	\$61 98	\$60 82	.....	.....	\$58 10	\$57 03
Ayrshire .....	63 73	62 56	59 72	58 58	77 15	75 77	\$69 49	\$68 23	66 70	65 48
Devon .....	48 40	47 51	50 81	49 85	.....	.....	.....	.....	49 36	48 44
Guernsey .....	75 37	74 13	102 87	101 26	.....	.....	.....	.....	89 13	87 70
Holstein-Friesian....	66 08	64 80	103 45	102 35	.....	.....	.....	.....	75 37	74 04
Jersey .....	74 15	72 89	81 93	80 59	102 77	101 19	119 77	118 03	88 21	86 80
Shorthorn .....	57 76	56 68	104 77	103 15	.....	.....	.....	.....	81 27	79 92

TABLE C — SUMMARY OF AVERAGE PROFIT PER COW DERIVED FROM SELLING CREAM.

BREED.	Number of cows.	Total number of periods of lactation.	Average amount of profit per cow from selling cream for one period of lactation.	Relative profit from selling cream.
Devon .....	3	5	\$48 44	100
American Holderness.....	2	4	57 08	118
Ayrshire .....	4	12	65 48	135
Holstein-Friesian .....	4	4	74 04	153
Shorthorn.....	1	2	79 92	165
Jersey .....	4	11	86 80	180
Guernsey .....	4	6	87 70	181

## 15. GENERAL SUMMARY.

In the two tables following we present, first, the actual average, by breeds, of all the results obtained in connection with butter and cream; and, second, the results expressed in a relative way, based, in each case, on 100 for the lowest result given by any breed.

TABULATED SUMMARY GIVING COMPARISON OF RESULTS SECURED WITH DIFFERENT BREEDS OF DAIRY CATTLE  
WITH REFERENCE TO THE PRODUCTION OF BUTTER AND CREAM—AVERAGE PER COW FOR ONE PERIOD (10  
MONTHS) OF LACTATION.

	American Holsteins.	Ayrshire.	Devon.	Guernsey.	Holstein- Friesian.	Jersey.	Shorthorn.
Number of cows.....	2	4	3	4	4	4	1
Total number of periods of lactation.....	4	12	5	6	4	11	2
Per cent. of fat in milk.....	3.73	3.60	4.60	5.30	3.86	5.60	4.44
Pounds of milk-fat produced.....	213.1	244.8	183.3	285.5	266.1	282.1	269.0
Pounds of butter produced.....	239.9	275.2	208.4	325.6	298.1	322.4	305.1
Pounds of butter made from 100 pounds of milk.....	4.20	4.05	5.22	6.05	3.76	6.40	5.04
Pounds of milk to make one pound of butter.....	23.80	24.70	19.15	16.53	26.60	15.63	19.84
Pounds of butter made for one pound of milk-fat.....	1.126	1.125	1.135	1.14	1.12	1.143	1.135
Cost in cents of one pound of milk-fat.....	20.13	20.15	20.47	16.14	19.06	16.12	17.18
Cost in cents of one pound of butter.....	17.90	17.92	18.00	14.15	17.02	14.11	15.15
Money value of butter produced.....	\$59.98	\$68.80	\$52.10	\$81.40	\$74.53	\$80.60	\$76.28
Profit derived from butter.....	17.08	19.48	14.58	35.25	23.80	35.11	30.06
Pounds of cream produced.....	1065.5	1224	916.5	1427.5	1830.5	1410.5	1345
Pounds of milk for one pound of cream.....	5.37	5.58	4.35	3.80	5.95	3.60	4.50
Cost in cents of cream per pound.....	4.03	4.03	4.09	3.23	3.81	3.22	3.44
Cost in cents of cream per quart ..	8.50	8.50	8.68	6.82	8.04	6.79	7.26
Money value of cream produced ..	\$101.00	\$116.02	\$86.86	\$135.27	\$126.10	\$133.70	\$127.48
Profit derived from cream.....	57.03	65.48	48.44	87.70	74.04	86.80	79.92

TABLED SUMMARY GIVING COMPARISON OF RESULTS SECURED WITH DIFFERENT BREEDS OF DAIRY CATTLE  
WITH REFERENCE TO THE PRODUCTION OF BUTTER AND CREAM. FIGURES BASED ON LOWEST RESULTS AS 100.

	American Holderness	Ayrshire.	Devon.	Guernsey.	Holstein- Friesian.	Jersey.	Shorthorn.
Relative per cent. of milk fat.....	111	107	137	160	100	167	132
Relative amount of milk-fat produced.....	116	134	100	156	145	154	147
Relative amount of butter produced.....	115	133	100	156	143	154	146
Relative amount of butter made from 100 pounds of milk.....	113	108	139	161	100	170	134
Relative amount of milk for one pound of butter..	152	158	122	106	170	100	127
Relative cost of one pound of milk-fat.....	124.9	125	127	100.1	118	100	107
Relative cost of one pound of butter.....	126.9	127	138	100.2	120	100	107
Relative money value of butter.....	115	132	100	156	143	155	146
Relative profit from butter.....	117	134	100	243	163	241	206
Relative amount of cream produced.....	116	134	100	156	154	145	147
Relative amount of milk required to make cream..	149	155	121	106	165	100	135
Relative cost of cream.....	125	125	137	100.3	118	100	107
Relative money value of cream produced.....	116	134	100	156	145	154	147
Relative profit from selling cream.....	118	135	100	181	163	180	165

## VII. COMPARISON OF DIFFERENT BREEDS OF DAIRY COWS WITH REFERENCE TO THE PRODUCTION OF CHEESE.

In the Tenth Annual Report of this Station, pp. 364-9, the chemist made a comparison of dairy breeds of cattle with reference to the production of cheese. The amount of cheese was calculated from the composition of the milk; the method of calculation was based upon some preliminary experiments in cheese manufacture and the results were put forward as tentative. Since then our very extended series of experiments in cheese making have brought to our knowledge a more definite understanding of the relation of composition of milk to composition and yield of cheese. We are, therefore, now in possession of facts that enable us to determine with great exactness from the composition of milk the yield and composition of cheese made from such milk. In an investigation of this kind it would be impracticable to make cheese, and it is found to be unnecessary, just as we find it unnecessary to make butter in order to ascertain the butter yield.

Our cheese investigation has established the fact that two, and only two, constituents of milk are concerned, to any extent, in cheese-making; these two are fat and casein. Casein, as used here, includes only the compound precipitated by rennet and acids. The amount of fat and casein in cheese depends mainly upon the amount of these two compounds in milk.

The amount of water, which constitutes most of the cheese that remains after removing fat and casein, is found to vary in a manner independent of the composition of the milk. Such variation in the amount of water in cheese depends largely upon the conditions of manufacture. Portions of the same milk can be made into cheese containing greatly varying amounts of water. But under the same conditions, a given amount of fat and of casein will make the same amount of cheese, because they will retain the same amount of water.

If we know the amount of fat and casein in milk, we can calculate the amount of cheese yield with as great accuracy as we

can estimate the butter yield from knowing the per cent. of fat in milk. Our work justifies us in saying that we can find the yield of green cheese from 100 pounds of any milk by multiplying the per cent. of fat by 1.1 pounds and the per cent. of casein by 2.5 lbs. and adding together the two products. For example, suppose a milk contains 4 per cent. of fat and 2.66 per cent. of casein, how much cheese should be made from it? 4 multiplied by 1.1 pounds equals 4.4 pounds; 2.66 multiplied by 2.5 pounds equals 6.65 pounds. Adding together 4.4 pounds and 6.65 pounds we have 11.05 pounds, as the amount of green cheese produced by 100 pounds of such milk. If a cheese-maker produces less than this amount, he either retains less than the average amount of water or he loses some fat and casein in the process of manufacture, or he may suffer loss from both causes. On the other hand, if a cheese-maker produces more cheese than the above amount, he accomplishes this by retaining more water than the average amount. The rule above given holds good, so far as the composition of milk is concerned, in the yield of average green cheese, as made in New York. We know of no rule that can possibly cover the cases of individual variations that are due to variations in conditions of manufacture.

In calculating the amount of cheese that can be made from the milk of different cows, we have made use of this rule, and are confident of presenting much more consistent and reliable results than we could possibly secure by attempting to make cheese with the small amounts of milk at hand. And even if we had large amounts of milk to use, it would be difficult to keep the conditions of manufacture so uniform in all cases as to secure results equally uniform as those secured by calculation.

We shall present our data relating to the comparison of different breeds of dairy cattle in connection with the production of cheese under the following heads:

1. Amount of fat and casein produced in milk.
2. Amount of cheese produced.
3. Amount of cheese produced from 100 pounds of milk.
4. Amount of milk required to produce one pound of cheese.
5. Relation of fat in milk to yield of cheese.
6. Cost of one pound of cheese.
7. Money value of cheese produced.

8. Profit derived from cheese.

9. General summary.

As in previous bulletins of this series, the data are presented in three separate tables under each head.

1. AMOUNT OF FAT AND CASEIN PRODUCED IN MILK.

As the basis of determining the amount of cheese made from the milk, we present first the amounts of fat and of casein contained in the milk of the different cows and breeds. The specific relation of fat to casein in the milk of different cows we reserve for another head.

TABLE A—SHOWING POUNDS OF FAT AND CASEIN IN MILK.

Breed.	NAME OF COW.	PERIOD OF LACTATION.							
		FIRST.		SECOND.		THIRD.		FOURTH.	
		Pounds of fat.	Pounds of casein.	Pounds of fat.	Pounds of casein.	Pounds of fat.	Pounds of casein.	Pounds of fat.	Pounds of casein.
American Holderness	Maggie 6th	164.1	107.8	227.4	149.4	231.4	152.1	.....	.....
American Holderness	Nora	229.5	147.9	.....	.....	.....	.....	.....	.....
Ayrshire	Junietta Peerless	.....	.....	233.4	158.7	304.4	207.1	.....	.....
Ayrshire	Manton Belle	210.8	188.4	232.0	162.7	292.5	197.6	266.7	170.3
Ayrshire	Miss Flow 5th	217.3	149.3	176.0	120.9	231.4	159.0	236.8	162.5
Ayrshire	Queen Duchess	270.8	181.4	266.7	178.8	.....	.....	.....	.....
Devon	Artalia	217.1	150.5	.....	.....	.....	.....	.....	.....
Devon	Genevie's Gift	145.0	81.8	209.7	118.4	.....	.....	.....	.....
Devon	Ione	169.8	102.4	175.0	107.2	.....	.....	.....	.....
Guernsey	Madame Select	.....	.....	292.4	169.2	.....	.....	.....	.....
Guernsey	Ortole	261.4	143.0	326.1	178.3	.....	.....	.....	.....
Guernsey	Rosette Ford	241.9	180.6	350.4	188.7	.....	.....	.....	.....
Guernsey	Stella Select	240.7	132.8	.....	.....	.....	.....	.....	.....
Holstein-Friesian	Beauty Pledge	.....	.....	322.8	177.9	.....	.....	.....	.....
Holstein-Friesian	Esel 2d	281.7	212.6	.....	.....	.....	.....	.....	.....
Holstein-Friesian	Netherland Constance	277.1	216.8	.....	.....	.....	.....	.....	.....
Holstein-Friesian	Ruth	182.7	132.7	.....	.....	.....	.....	.....	.....
Jersey	Albert's Carol	244.2	125.0	256.4	131.3	.....	.....	.....	.....
Jersey	Barbara Allen	245.3	129.3	256.8	135.8	947.2	183.0	.....	.....
Jersey	Countess Flavia	294.4	161.9	292.2	160.7	285.4	157.8	347.8	189.6
Jersey	Gilderbloom	226.1	120.6	.....	.....	307.8	164.2	.....	.....
Shorthorn	Betsy 10th	214.7	138.0	323.8	207.8	.....	.....	.....	.....

TABLE B—SHOWING AVERAGE AMOUNTS PER COW OF FAT AND CASEIN IN MILK.

BREED.	FIRST PERIOD OF LACTATION.		SECOND PERIOD OF LACTATION.		THIRD PERIOD OF LACTATION.		FOURTH PERIOD OF LACTATION.		AVERAGE OF ALL PERIODS OF LACTATION.	
	Pounds of fat.	Pounds of casein.	Pounds of fat.	Pounds of casein.	Pounds of fat.	Pounds of casein.	Pounds of fat.	Pounds of casein.	Pounds of fat.	Pounds of casein.
American Holderness .	196.8	127.9	227.4	149.4	231.4	153.1	.....	.....	213.1	139.3
Ayrshire .....	232.8	156.4	227.0	152.8	276.1	187.9	251.5	166.4	244.8	164.7
Devon .....	177.3	111.6	192.4	112.8	.....	.....	.....	.....	183.8	112.1
Guernsey .....	248.0	132.1	323.0	178.7	.....	.....	.....	.....	285.5	155.4
Holstein-Friesian .....	247.2	137.4	323.8	177.9	.....	.....	.....	.....	266.1	185.0
Jersey .....	252.5	134.2	368.5	142.4	313.5	168.3	347.8	189.6	283.1	150.8
Shorthorn .....	214.7	133.0	323.3	207.8	.....	.....	.....	.....	269.0	172.9

TABLE C—SHOWING SUMMARY OF AMOUNT OF FAT AND CASEIN IN MILK.

BREED.	Number of cows.	Total number of periods of lactation.	Average amount of milk-fat produced per cow in one lactation period.	Relative amount of fat produced.	Average amount of casein produced per cow in one lactation period.	Relative amount of casein produced.
			Pounds.		Pounds.	
Devon.....	3	5	183.3	100	112.1	100
American Holderness.....	2	4	213.1	116	139.3	124
Ayrshire.....	4	12	244.8	134	164.7	147
Holstein-Friesian.....	4	4	266.1	145	185.8	165
Shorthorn.....	1	2	269.0	147	172.9	154
Jersey.....	4	11	282.1	154	150.8	135
Guernsey.....	4	6	285.5	156	155.4	139

## 2. AMOUNT OF CHEESE PRODUCED.

The method of calculating the amount of cheese production from the composition of the milk has already been given above. It will be noticed in general that the cows and breeds producing milk rich in fat make good yields of cheese. Of course, the final basis of comparison must be not merely the amount of cheese produced, but rather the amount of profit derived from selling milk in this form, which depends upon the factors of amount of cheese produced and the cost of its production.

TABLE A — SHOWING AMOUNT OF GREEN CHEESE PRODUCED.

Breed.	NAME OF COW.	PERIOD OF LACTATION.			
		First.	Second.	Third.	Fourth.
		Pounds.	Pounds.	Pounds.	Pounds.
American Holderness.....	Maggie 6th.....	460.0	638.6	684.8	.....
American Holderness.....	Nora.....	633.2	.....	.....	.....
Ayrshire.....	Junietta Peerless.....	.....	653.5	852.6	.....
Ayrshire.....	Manton Belle.....	577.3	637.0	815.8	719.1
Ayrshire.....	Miss Flow 5th.....	612.3	495.9	652.0	668.2
Ayrshire.....	Queen Duchess.....	751.4	740.1	.....	.....
Devon.....	Artalia.....	615.1	.....	.....	.....
Devon.....	Genevie's Gift.....	394.0	536.7	.....	.....
Devon.....	Ione.....	443.8	460.5	.....	.....
Guernsey.....	Madame Select.....	.....	744.6	.....	.....
Guernsey.....	Oriole.....	645.0	304.5	.....	.....
Guernsey.....	Rosette Ford.....	592.6	857.2	.....	.....
Guernsey.....	Stella Select.....	571.8	.....	.....	.....
Holstein-Friesian.....	Beauty Pledge.....	.....	799.8	.....	.....
Holstein-Friesian.....	Eel 2d.....	841.4	.....	.....	.....
Holstein-Friesian.....	Netherland Constance.....	846.8	.....	.....	.....
Holstein-Friesian.....	Ruth.....	532.7	.....	.....	.....
Jersey.....	Albert's Carol.....	591.1	610.3	.....	.....
Jersey.....	Barbara Allen.....	593.1	620.7	839.4	.....
Jersey.....	Countess Flavia.....	728.6	723.2	708.4	856.6
Jersey.....	Gilderbloom.....	590.2	.....	749.1	.....
Shorthorn.....	Betsey 10th.....	581.2	875.1	.....	.....

TABLE B—SHOWING AVERAGE AMOUNT OF GREEN CHEESE  
PRODUCED PER COW.

BREED.	First period of lactation.	Second period of lactation.	Third period of lactation.	Fourth period of lactation.	Average of all pe- riods of lactation.
	Pounds.	Pounds.	Pounds.	Pounds.	Pounds.
American Holderness.	536.2	623.6	634.8	.....	582.7
Ayrshire .....	647.0	631.7	773.5	692.7	681.1
Devon .....	474.0	493.6	.....	.....	481.9
Guernsey .....	603.1	802.1	.....	.....	702.6
Holstein-Friesian .....	740.4	799.8	.....	.....	755.2
Jersey .....	613.3	651.4	765.6	856.6	687.3
Shorthorn .....	581.2	875.1	.....	.....	728.2

TABLE C—SHOWING SUMMARY OF AMOUNT OF GREEN CHEESE  
PRODUCED.

BREED.	Number of cows.	Total number of periods of lac- tation.	Average amount of green cheese produced per cow for one period of lac- tation.	Relative amount of cheese pro- duced.
			Pounds.	
Devon .....	3	5	481.9	100
American Holderness .....	2	4	582.7	121
Ayrshire .....	4	12	681.1	141
Jersey .....	4	11	687.3	143
Guernsey .....	4	6	702.6	146
Shorthorn .....	1	2	728.2	151
Holstein-Friesian .....	4	4	755.2	157

### 3. AMOUNT OF CHEESE PRODUCED FROM ONE HUNDRED POUNDS OF MILK.

The data presented under this head are of interest in connection with the much-discussed subject of variation of cheese yield from different kinds of milk. These data represent normal milk varying in respect to fat-content from below 3 to over 6 per cent. Without going into a detailed discussion, it is interesting to note that the amount of cheese made from 100 pounds of milk varied between the wide limits of 8.4 and 15.62 pounds, a difference of seven and one-fourth pounds of cheese from the same amount of milk.

TABLE A.—SHOWING AMOUNT OF CHEESE MADE FROM 100 POUNDS OF MILK.

Breed.	NAME OF COW.	PERIOD OF LACTATION.			
		First.	Second.	Third.	Fourth.
		Pounds.	Pounds.	Pounds.	Pounds.
American Holderness	Maggie 6th	9.57	10.20	10.75	9.81
American Holderness	Nora	10.10			10.95
Ayrshire	Junietta Peerless		8.95	9.60	
Ayrshire	Manton Belle	9.17	10.09	10.02	
Ayrshire	Miss Flow 5th	11.95	9.70	10.02	
Ayrshire	Queen Duchess	10.75	10.14		
Devon	Artalia	12.26			
Devon	Genevieve's Gift	11.94	13.14		
Devon	Lone	11.23	11.86		
Guernsey	Madame Select		15.62		
Guernsey	Oriole	12.40	18.87		
Guernsey	Rosette Ford	12.18	14.02		
Guernsey	Stella Select	10.73			
Holstein-Friesian	Beauty Pledge		9.85		
Holstein-Friesian	Eel 2d	11.50			
Holstein-Friesian	Netherland Constance	8.95			
Holstein-Friesian	Ruth	8.40			
Jersey	Albert's Carol	12.80	13.91		
Jersey	Barbara Allen	12.85	12.00	13.06	
Jersey	Countess Flavia	14.27	14.41	15.11	15.00
Jersey	Gilderbloom	13.76		18.87	
Shorthorn	Betsy 10th	11.58	12.34		

TABLE B—SHOWING AVERAGE AMOUNT OF CHEESE MADE FROM 100 POUNDS OF MILK.

BREED.	First period of lactation.	Second period of lactation.	Third period of lactation.	Fourth period of lactation.	Average of all periods of lactation.
	Pounds.	Pounds.	Pounds.	Pounds.	Pounds.
American Holderness .	9.87	10.20	10.75	.....	10.18
Ayrshire . . . . .	10.53	9.71	9.86	10.03	9.98
Devon . . . . .	11.83	12.47	.....	.....	12.10
Guernsey . . . . .	11.75	14.24	.....	.....	13.05
Holstein-Friesian . . . . .	9.61	9.35	.....	.....	9.54
Jersey . . . . .	13.28	13.40	13.70	15.00	13.62
Shorthorn . . . . .	11.58	12.34	.....	.....	12.03

TABLE C—SHOWING SUMMARY OF AVERAGE AMOUNT OF CHEESE MADE FROM 100 POUNDS OF MILK.

BREED.	Number of cows	Total number of periods of lactation.	Average amount of cheese made from 100 lbs. of milk.	Relative amount of cheese made from milk.
			Pounds.	
Holstein-Friesian . . . . .	4	4	9.54	100
Ayrshire . . . . .	4	12	9.98	104
American Holderness . . . . .	2	4	10.18	107
Shorthorn . . . . .	1	2	12.03	126
Devon . . . . .	3	5	12.10	127
Guernsey . . . . .	4	6	13.05	137
Jersey . . . . .	4	11	13.62	143

## 4. AMOUNT OF MILK REQUIRED TO MAKE ONE POUND OF CHEESE.

TABLE A—SHOWING AMOUNT OF MILK REQUIRED TO MAKE ONE POUND OF CHEESE.

Breed.	NAME OF COW.	PERIOD OF LACTATION.			
		First.	Second.	Third.	Fourth.
		Pounds.	Pounds.	Pounds.	Pounds.
American Holderness.	Maggie 6th.	10.45	9.80	9.80	10.74
American Holderness.	Nora.	9.90			9.18
Ayrshire.	Junietta Peerless.		11.17	10.42	
Ayrshire.	Manton Belle.	10.91	9.91	9.98	
Ayrshire.	Miss Flow 5th.	8.86	10.32	9.98	
Ayrshire.	Queen Duchess.	9.80	9.86		
Devon.	Artalia.	8.15			
Devon.	Genevieve's Gift.	8.38	7.61		
Devon.	Ione.	8.91	8.48		
Guernsey.	Madame Select.		6.41		
Guernsey.	Ortolo.	8.07	7.48		
Guernsey.	Rosette Ford.	8.21	7.18		
Guernsey.	Stella Select.	9.38			
Holstein-Friesian.	Beauty Pledge.		10.70		
Holstein-Friesian.	Esel 2d.	8.69			
Holstein-Friesian.	Netherland Constance.	11.17			
Holstein-Friesian.	Ruth.	11.90			
Jersey.	Albert's Carol.	8.13	7.19		
Jersey.	Barbara Allen.	7.78	8.84	7.64	
Jersey.	Countess Flavia.	7.00	6.94	6.62	6.67
Jersey.	Gilderbloom.	7.27		7.53	
Shorthorn.	Betsy 10th.	8.63	8.10		

TABLE B—SHOWING AVERAGE AMOUNT OF MILK REQUIRED TO MAKE ONE POUND OF CHEESE.

BREED.	First period of lactation.	Second period of lactation.	Third period of lactation.	Fourth period of lactation.	Average of all periods of lactation.
	Pounds.	Pounds.	Pounds.	Pounds.	Pounds.
American Holderness...	10.13	9.80	9.80	.....	9.82
Ayrshire.....	9.50	10.30	10.14	9.97	10.02
Devon.....	8.45	8.02	.....	.....	8.27
Guernsey.....	8.51	7.02	.....	.....	7.66
Holstein-Friesian.....	10.41	10.70	.....	.....	10.48
Jersey.....	7.53	7.46	7.30	6.67	7.34
Shorthorn.....	8.63	8.10	.....	.....	8.31

TABLE C—SHOWING SUMMARY OF AVERAGE AMOUNT OF MILK REQUIRED TO MAKE ONE POUND OF CHEESE.

BREED.	Number of cows.	Total number of periods of lactation.	Average amount of milk required to make one pound of cheese.	Relative amount of milk required to make cheese.
			Pounds.	
Jersey.....	4	11	7.34	100
Guernsey.....	4	6	7.66	104
Devon.....	3	5	8.27	113
Shorthorn.....	1	2	8.31	113
American Holderness.....	2	4	9.82	134
Ayrshire.....	4	12	10.02	137
Holstein-Friesian.....	4	4	10.48	143

## 5. RELATION OF FAT IN MILK TO YIELD OF CHEESE.

We have made a special study of the relation of fat in milk to yield of cheese in the case of cheese-factory milk, and our general results point to the conclusion that, with milk as found in the cheese factories of our State, the fat and cheese yield increases usually in uniform proportions, so that the fat may be regarded as a fair measure of the cheese-yielding power of milk. Of

course, in our farm dairies, the variations in composition of milk are not extreme, though they are sufficient to be of practical importance and to affect the method of paying for milk. We do not often find the milk of cheese-factory dairies averaging more than 1 per cent. apart in fat. Those who have herds of cows bred to produce milk rich in fat refuse to pool their milk with that of the ordinary dairy and receive equal pay per 100 pounds of milk.

TABLE SHOWING RELATION OF FAT IN MILK TO YIELD OF CHEESE.

Breed.	NAME OF COW.	Period of lactation.	Per cent. of fat in milk.	Pounds of cheese made from 100 pounds of milk.	Pounds of cheese made for one pound fat in milk.
Holstein-Friesian	Ruth .....	First.....	2.88	8.40	2.92
Holstein-Friesian	Netherland Constance.....	First.....	2.93	8.95	3.05
Ayrshire	Junietta Peerless.....	Second...	3.20	8.95	2.80
Ayrshire	Manton Belle .....	First.....	3.36	9.17	2.73
Ayrshire	Junietta Peerless .....	Third.....	3.43	9.60	2.80
Ayrshire	Miss Flow 5th .....	Second...	3.44	9.70	2.82
Ayrshire	Manton Belle .....	Fourth...	3.45	9.31	2.70
American Holderness	Maggie 6th .....	First.....	3.49	9.57	2.74
Ayrshire	Miss Flow 5th .....	Third.....	3.56	10.02	2.82
Ayrshire	Manton Belle .....	Third.....	3.59	10.02	2.79
Ayrshire	Queen Duchess.....	Second...	3.66	10.14	2.77
Ayrshire	Manton Belle .....	Second...	3.67	10.09	2.75
American Holderness	Maggie 6th .....	Second...	3.72	10.20	2.74
American Holderness	Nora.....	First.....	3.72	10.10	2.72
Holstein-Friesian	Beauty Pledge.....	Second...	3.77	9.35	2.48
Holstein-Friesian	Eael 2d.....	First.....	3.85	11.50	2.98
Ayrshire	Queen Duchess.....	First.....	3.87	10.75	2.77
Ayrshire	Miss Flow 5th .....	Fourth...	3.88	10.95	2.82
Ayrshire	Maggie 6th .....	Third.....	3.92	10.75	2.74
American Holderness	Miss Flow 5th .....	First.....	4.24	11.95	2.82
Ayrshire	Betsey 10th.....	First.....	4.28	11.58	2.71
Shorthorn	Ione.....	First.....	4.30	11.23	2.61
Devon	Artalia .....	First.....	4.33	12.26	2.83
Devon	Ione.....	Second...	4.50	11.86	2.61

Guernsey	Stella Select.	First.....	4.51	10.73	2.38
Shorthorn	Betsy 10th	Second...	4.56	12.34	2.71
Devon	Ione	First.....	4.75	11.94	2.51
Jersey	Barbara Allen	Second...	4.96	12.00	2.42
Guernsey	Rosette Ford	First.....	4.97	12.18	2.45
Guernsey	Oriole	First.....	5.02	12.40	2.47
Jersey	Albert's Carol	First.....	5.17	12.30	2.38
Devon	Genevie's Gift	Second...	5.23	13.14	2.51
Jersey	Barbara Allen	First.....	5.31	12.85	2.43
Jersey	Barbara Allen	Third....	5.41	13.08	2.42
Guernsey	Oriole	Second...	5.42	13.37	2.47
Jersey	Gilderbloom	Third....	5.45	13.27	2.44
Jersey	Gilderbloom	First.....	5.65	13.76	2.44
Guernsey	Rosette Ford	Second...	5.73	14.02	2.45
Jersey	Countess Flavia	First.....	5.75	14.27	2.48
Jersey	Countess Flavia	Second...	5.82	14.41	2.48
Jersey	Albert's Carol	Second...	5.85	13.91	2.38
Jersey	Countess Flavia	Third....	6.09	15.11	2.48
Jersey	Countess Flavia	Fourth....	6.09	15.00	2.48
Guernsey	Madame Select	Second...	6.13	15.62	2.55

The data furnished by our investigation enable us to compare extreme cases, such as we very rarely find in actual practice, and thus to answer questions which we have heretofore been unable to reply to with certainty. In larger herds of cattle of different breeds, we should, perhaps, find somewhat smaller average differences in composition of milk but, in any case, such differences would be marked.

We present above the results of individual cows in the order of the per cent. of fat in milk, commencing with the lowest.

An examination of the table above shows that there is more or less variation in the relation of fat to cheese yield but that the results are fairly uniform within certain limits. This latter fact can be made prominent by grouping the results in the following manner :

GROUP.	Per cent. of fat in milk.	Pounds of green cheese made from 100 pounds of milk.	Pounds of green cheese made for one pound of fat in milk.
1.....	2.80-3	8.67	2.98
2.....	3-3.25	8.95	2.80
3.....	3.25-3.5	9.47	2.76
4.....	3.5 -3.75	10.10	2.76
5.....	3.75-4	10.66	2.76
6.....	4-4.25	11.95	2.83
7.....	4.25-4.5	11.69	2.72
8.....	4.5 -4.75	11.64	2.58
9.....	4.75-5	12.04	2.46
10.....	5-5.25	12.61	2.45
11.....	5.25-5.5	13.14	2.44
12.....	5.5 -5.75	13.89	2.44
13.....	5.75-6	14.20	2.44
14..	6 -6.25	15.24	2.50

An examination of the foregoing tabulated summary reveals some very interesting facts.

1. In milk containing less than 3 per cent. of fat, the cheese yield for one pound of fat is much higher than the average.

2. In milk containing from 3 to 4.5 per cent. of fat the amount of cheese made for one pound of fat is quite uniform and the average is nearly the same as that secured in all our previous

work at cheese factories. These are the limits within which the per cent. of fat of most cheese-factory milks fall. These results agree in a surprising way with those secured in our more extended investigation, especially when we consider that these are results obtained with individual cows instead of herds.

3. In milk containing 5 to 6 per cent. of fat or more, the amount of cheese made for one pound of fat was noticeably less than in milk containing 4.5 per cent. of fat or less; but in milk containing 5 per cent. of fat or more up to 6.13 per cent. of fat, we have very uniform results, so that these data point to the fact that milk containing 6 per cent. or more of fat will yield as much cheese per pound of fat as will milk containing less than 6 per cent. of fat down as low as 5 per cent.

We now give tables A, B, C bearing on the same point.

TABLE A — SHOWING POUNDS OF CHEESE MADE FOR ONE POUND OF FAT IN MILK.

Breed.	NAME OF COW.	PERIOD OF LACTATION.											
		FIRST.			SECOND.			THIRD.			FOURTH.		
		Per cent. of fat in milk.	Cheese from 100 pounds milk.	Pounds of cheese for one pound fat in milk.	Per cent. of fat in milk.	Cheese from 100 pounds milk.	Pounds of cheese for one pound fat in milk.	Per cent. of fat in milk.	Cheese from 100 pounds milk.	Pounds of cheese for one pound fat in milk.	Per cent. of fat in milk.	Cheese from 100 pounds milk.	Pounds of cheese for one pound fat in milk.
American Holderness	Maggie 6th	3.49	9.57	2.74	3.73	10.30	2.74	3.93	10.76	2.74	.....	.....	.....
American Holderness	Nora	3.73	10.10	2.73	.....	.....	.....	.....	.....	.....	.....	.....	.....
Ayrshire	Junetta Peeries	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Ayrshire	Manton Belle	3.30	9.17	2.73	3.30	8.95	2.50	2.43	9.80	2.80	.....	.....	.....
Ayrshire	Miss Flow 5th	4.34	11.95	2.83	3.07	10.09	2.76	3.59	10.03	2.70	.....	.....	.....
Ayrshire	Queen Duchess	3.87	10.76	2.77	3.41	9.70	2.82	3.56	10.03	2.83	.....	.....	.....
Devon	Artalia	.....	.....	.....	3.66	10.14	2.77	.....	.....	.....	.....	.....	.....
Devon	Genevieve's Gift	4.33	3.36	2.83	.....	.....	.....	.....	.....	.....	.....	.....	.....
Devon	Ione	4.76	11.33	2.61	5.33	13.14	2.51	.....	.....	.....	.....	.....	.....
Guernsey	Madame Select	.....	.....	.....	4.50	11.86	.....	.....	.....	.....	.....	.....	.....
Guernsey	Orion	5.03	13.40	2.47	6.13	15.62	2.55	.....	.....	.....	.....	.....	.....
Guernsey	Rosette Ford	4.97	12.18	2.46	5.43	13.37	2.47	.....	.....	.....	.....	.....	.....
Guernsey	Stella Select	4.51	10.72	2.39	5.73	14.03	2.45	.....	.....	.....	.....	.....	.....
Holstein-Friesian	Beauty Pledge	.....	.....	.....	3.77	9.36	2.43	.....	.....	.....	.....	.....	.....
Holstein-Friesian	Ezel 3d	3.83	11.50	2.98	.....	.....	.....	.....	.....	.....	.....	.....	.....
Holstein-Friesian	Netherland Constance	2.98	8.96	3.05	.....	.....	.....	.....	.....	.....	.....	.....	.....
Holstein-Friesian	Ruth	2.98	8.40	2.92	.....	.....	.....	.....	.....	.....	.....	.....	.....
Jersey	Albert's Carol	5.17	12.30	2.38	5.33	13.31	2.38	.....	.....	.....	.....	.....	.....
Jersey	Barbara Allen	5.41	13.86	2.43	4.93	12.00	2.43	.....	.....	.....	.....	.....	.....
Jersey	Countess Flavia	5.76	14.37	2.43	5.83	14.41	2.46	.....	.....	.....	.....	.....	.....
Jersey	Gliderbloom	5.65	13.76	2.44	.....	.....	.....	.....	.....	.....	.....	.....	.....
Shorthorn	Betsy 10th	4.36	11.58	2.71	4.56	12.34	2.71	.....	.....	.....	.....	.....	.....

TABLE B — SHOWING AVERAGE AMOUNT OF CHEESE MADE FOR ONE POUND OF FAT IN MILK.

	FIRST PERIOD OF LACTATION.			SECOND PERIOD OF LACTATION.			THIRD PERIOD OF LACTATION.			FOURTH PERIOD OF LACTATION.			AVERAGE OF ALL PERIODS OF LACTATION.		
	Per cent. of fat in milk.	Cheese from 100 pounds milk.	Pounds of cheese for one pound of fat in milk.	Per cent. of fat in milk.	Cheese from 100 pounds milk.	Pounds of cheese for one pound of fat in milk.	Per cent. of fat in milk.	Cheese from 100 pounds milk.	Pounds of cheese for one pound of fat in milk.	Per cent. of fat in milk.	Cheese from 100 pounds milk.	Pounds of cheese for one pound of fat in milk.	Per cent. of fat in milk.	Cheese from 100 pounds milk.	Pounds of cheese for one pound of fat in milk.
American Holderness.....	3.62	9.87	2.73	3.72	10.20	2.74	3.92	10.75	2.74	...	...	...	3.73	10.18	2.73
Ayrshire .....	3.79	10.53	2.78	3.49	9.71	2.79	3.53	9.86	2.80	...	...	...	3.60	9.98	2.77
Devon .....	4.43	11.83	2.67	4.96	12.47	2.57	...	...	...	...	...	...	4.60	12.10	2.65
Guernsey .....	4.83	11.75	2.43	5.73	14.24	2.50	...	...	...	...	...	...	5.30	13.05	2.46
Holstein-Friesian.....	3.92	9.61	2.96	3.77	9.35	2.46	...	...	...	...	...	...	3.86	9.54	2.84
Jersey .....	5.47	13.28	2.43	5.53	13.40	2.43	...	...	...	...	...	...	5.60	13.63	2.43
Shorthorn .....	4.23	11.58	2.71	4.56	12.34	2.71	...	...	...	...	...	...	4.44	12.03	2.71

TABLE C—SHOWING SUMMARY OF AVERAGE AMOUNT OF CHEESE  
MADE FOR ONE POUND OF FAT IN MILK.

BREED.	Number of cows.	Total number of periods of lactation.	Per cent. of fat in milk.	Pounds of cheese made from 100 pounds of milk.	Pounds of cheese made for one pound of fat in milk.	Relative amount of cheese made for fat in milk.
Holstein-Friesian.....	4	4	3.36	9.54	2.84	117
Ayrshire.....	4	12	3.60	9.98	2.77	114
American Holderness.....	2	4	3.78	10.18	2.73	112
Shorthorn.....	1	2	4.44	12.03	2.71	111
Devon.....	3	5	4.60	12.10	2.63	108
Guernsey.....	4	6	5.30	13.05	2.46	101
Jersey.....	4	11	5.60	13.62	2.43	100

In table C, above, we will suppose that each average given represents the season's average of a herd of cows, whose milk is being taken to a cheese factory. Taken the extreme cases, as represented by the Holstein-Friesian herd and by the Jersey herd, let us see what the results would be in paying for milk by different methods. In the table below we calculate the milk-fat at 25 cents per pound and the cheese at a price equivalent to this price of milk-fat, which would be  $9\frac{1}{2}$  cents per pound, granting that the cheese would all sell at a uniform price.

TABLE SHOWING RESULTS OF PAYING FOR MILK BY DIFFERENT  
METHODS.

HERD.	Per cent. fat in milk.	Pounds of cheese made from 100 pounds of milk.	Pounds of cheese made for one pound of fat in milk.	Value of 100 pounds of milk based on milk-fat at 25 cents per pound.	Value of 100 pounds of milk based on cheese made, at $9\frac{1}{2}$ cents per pound.	Value received by each for 100 pounds of milk based on weight of milk alone.
Holstein-Friesian..	3.36	9.54	2.84	\$0 84	\$0 92	\$1 12
Jersey.....	5.60	13.62	2.43	1 40	1 32	1 12

A study of the above figures leads to the following statements :

*First.* Comparing results of paying on basis of fat and on basis of actual cheese yield with these two herds, whose milk differs as

the milk of no two herds of cheese-factory cows differs for a whole season's average, we see that the poorer milk receives eight cents more per 100 pounds on the basis of actual cheese than on basis of fat, while the milk richer in fat receives that much less.

*Second.* If the cheese made from the richer milk sold for one-half cent more per pound than the other, then the fat-basis would be absolutely fair. Would the cheese made from the richer milk differ in composition enough to make the difference of one-half cent per pound? The following would represent the composition of the cheese made from these two milks:

COMPOSITION OF CHEESE.

HERD.	Per cent. of fat in cheese.	Per cent. of casein in cheese.	Per cent. of water, salt, etc., in cheese.
Holstein-Friesian .....	35.24	24.50	40.26
Jersey .....	41.05	21.94	37.06

It is clear from these figures that the cheese made from the two kinds of milk differs much in composition, since that made from the richer milk contains nearly 6 per cent. more of fat. Allowing that the cheese was made with equal skill, it is safe to say that the richer cheese would sell easily for a half cent more per pound.

*Third.* If the milk of each herd was paid for by weight alone, then each would receive the same amount, or one-half the total receipts, which would give \$1.12 to each milk.

*Fourth.* If the cheese sold for different prices, as indicated above, then the fat-basis would be strictly just and, as between this method and the method of paying by weight alone, the poorer milk would receive 28 cents more and the richer milk 28 cents less than each ought per 100 pounds of milk. But, granting that the cheese would all sell at one price, what would be the comparative justice of the fat-basis and the basis of weight alone? On the basis of the fat, the richer milk would receive eight cents more per 100 than its cheese yield would entitle it to. On the other

hand, on the basis of weight alone, the poorer milk would receive 20 cents more than it ought. Which is nearer justice, to receive eight cents or 20 cents more than belongs to one? But, from our considerations above relating to the difference in the actual composition and value of the cheese, there would not be likely to be the difference of even eight cents on the fat-basis, while there is no escape from the fact that the poorer milk would always receive 20 cents more than would belong to it on the basis of weight of milk alone.

These cases have been taken because they are extreme and are such as would not be likely to occur in common experience, but questions are often asked on just such points. Where the differences in composition of milk are less, the chance of doing any possible injustice in paying on basis of fat becomes proportionately less or practically disappears.

In this connection we present below a table showing the average composition of the cheese for the different herds.

TABLE SHOWING AVERAGE COMPOSITION OF CHEESE MADE FROM MILK OF DIFFERENT BREEDS.

BREED.	Per cent. of fat in cheese.	Per cent. of casein in cheese.	Per cent. of water, fat, etc., in cheese.	Per cent of fat in milk.
Holstein-Friesian . . . . .	35.24	24.50	40.26	3.36
Ayrshire . . . . .	35.95	24.20	39.85	3.60
American Holderness. . . . .	36.57	23.90	39.53	3.73
Shorthorn . . . . .	36.94	23.74	39.32	4.44
Devon . . . . .	38.04	23.26	38.70	4.60
Guernsey . . . . .	40.63	22.12	37.25	5.30
Jersey . . . . .	41.05	21.94	37.06	5.60

6. COST OF ONE POUND OF CHEESE.  
TABLE A—SHOWING COST OF ONE POUND OF CHEESE.

Breed.	NAME OF COW.	PERIOD OF LACTATION.			
		First.	Second.	Third.	Fourth.
		Cents.	Cents.	Cents.	Cents.
American Holderness.	Maggie 6th.	8.65	7.57	7.51	6.65
American Holderness.	Nora.	6.07			7.75
Ayrshire.	Junietta Peerless.		7.80	6.15	
Ayrshire.	Manton Belle.	7.83	8.00	7.15	
Ayrshire.	Miss Flow 5th.	7.92	8.15	7.72	
Ayrshire.	Queen Duchess.	6.52	6.66		
Devon.	Artalia.	6.80			
Devon.	Genevieve's Gift.	7.90	7.35		
Devon.	Ione.	8.24	9.12		
Guernsey.	Madame Select.		6.87		
Guernsey.	Oriole.	5.92	5.97		
Guernsey.	Rosette Ford.	6.90	6.42		
Guernsey.	Stella Select.	8.30			
Holstein-Friesian.	Beauty Pledge.		6.20		
Holstein-Friesian.	Ezel 2d.	6.26			
Holstein-Friesian.	Netherland Constance.	6.80			
Holstein-Friesian.	Ruth.	8.10			
Jersey.	Albert's Carol.	8.00	7.00		
Jersey.	Barbara Allen.	7.44	7.76	5.98	
Jersey.	Countess Flavia.	6.86	6.23	6.20	5.26
Jersey.	Gilderbloom.	7.58		5.80	
Shorthorn.	Betsy 10th.	7.57	5.54		

TABLE B — SHOWING AVERAGE COST OF ONE POUND OF CHEESE.

BREED.	First period of lactation.	Second period of lactation.	Third period of lactation.	Fourth period of lactation.	Average of all periods of lactation.
	Cents.	Cents.	Cents.	Cents.	Cents.
American Holderness ...	7.15	7.57	7.51	.....	7.36
Ayrshire .....	7.20	7.58	6.94	7.18	7.24
Devon .....	7.52	8.17	.....	.....	7.78
Guernsey .....	7.00	6.25	.....	.....	6.57
Holstein-Friesian .....	6.90	6.20	.....	.....	6.72
Jersey .....	7.42	6.95	5.98	5.26	6.62
Shorthorn .....	7.57	5.54	.....	.....	6.35

TABLE C — SHOWING SUMMARY OF AVERAGE COST OF ONE POUND OF CHEESE.

BREED.	Number of cows.	Total number of periods of lactation.	Average cost of one pound of cheese.	Relative cost of cheese.
			Cents.	
Shorthorn .....	1	2	6.35	100
Guernsey .....	4	6	6.57	103
Jersey .....	4	11	6.62	104
Holstein-Friesian .....	4	4	6.72	106
Ayrshire .....	4	12	7.24	114
American Holderness .....	2	4	7.36	116
Devon .....	3	5	7.78	123

## 7. MONEY VALUE OF CHEESE PRODUCED.

In calculating the money value of cheese, we place the average price of ripe cheese at 10 cents per pound, which would be equivalent to  $9\frac{3}{4}$  cents per pound for green cheese.

TABLE A — SHOWING MONEY VALUE OF CHEESE.

Breed.	NAME OF COW.	PERIOD OF LACTATION.			
		First.	Second.	Third.	Fourth.
American Holderness.....	Maggie 6th.....	\$43 50	\$60 38	\$81 36	.....
American Holderness.....	Nora.....	60 15	.....	.....	.....
Ayrshire.....	Junietta Peerless.....	.....	63 17	83 42	.....
Ayrshire.....	Manton Belle.....	55 81	61 57	78 86	\$69 51
Ayrshire.....	Miss Flow 6th.....	59 19	47 94	63 02	64 40
Ayrshire.....	Queen Duchess.....	72 64	71 64	.....	.....
Devon.....	Artalia.....	59 46	.....	.....	.....
Devon.....	Genevieve's Gift.....	35 18	50 92	.....	.....
Devon.....	Lone.....	43 80	44 53	.....	.....
Guernsey.....	Madame Select.....	.....	71 98	.....	.....
Guernsey.....	Oriole.....	62 35	77 77	.....	.....
Guernsey.....	Rosette Ford.....	57 28	82 86	.....	.....
Guernsey.....	Stella Select.....	55 37	.....	.....	.....
Holstein-Friesian.....	Beauty Pledge.....	.....	77 31	.....	.....
Holstein-Friesian.....	Eael 2d.....	81 44	.....	.....	.....
Holstein-Friesian.....	Netherland Constance.....	81 86	.....	.....	.....
Holstein-Friesian.....	Ruth.....	51 50	.....	.....	.....
Jersey.....	Albert's Carol.....	56 17	59 00	.....	.....
Jersey.....	Barbara Allen.....	57 33	60 00	81 14	.....
Jersey.....	Countess Flavia.....	70 43	69 91	68 46	82 80
Jersey.....	Gilderbloom.....	68 19	.....	73 41	.....
Shorthorn.....	Betsey 10th.....	56 18	84 59	.....	.....

TABLE B—SHOWING AVERAGE MONEY VALUE OF CHEESE PRODUCED PER COW.

BREED.	First period of lactation.	Second period of lactation.	Third period of lactation.	Fourth period of lactation.	Average of all periods of lactation.
American Holderness.	\$51 83	\$60 28	\$61 36	.....	\$56 33
Ayrshire .....	62 55	61 06	74 77	\$66 96	65 84
Devon .....	45 82	47 72	.....	.....	46 58
Guernsey .....	58 30	77 54	.....	.....	67 92
Holstein-Friesian .....	71 60	77 31	.....	.....	73 00
Jersey .....	59 28	62 97	74 00	82 80	66 44
Shorthorn .....	56 18	84 59	.....	.....	70 39

TABLE C—SHOWING SUMMARY OF AVERAGE MONEY VALUE OF CHEESE.

BREED.	Number of cows	Total number of periods of lactation.	Average money value of cheese produced per cow for one period of lactation.	Relative money value of cheese produced.
Devon .....	3	5	\$46 58	100
American Holderness .....	2	4	56 33	121
Ayrshire .....	4	12	65 84	141
Jersey .....	4	11	66 44	143
Guernsey .....	4	6	67 92	147
Shorthorn .....	1	2	70 39	151
Holstein-Friesian .....	4	4	73 00	157

## 8. PROFIT DERIVED FROM CHEESE.

In calculating the profit derived from selling milk in the form of cheese, we take from the money value the cost of food and, in addition,  $12\frac{1}{2}$  cents per 100 pounds of milk as the measure of the value of feeding and fertilizing materials sent from the farm. Essentially the same value of feeding and fertilizing constituents are taken from the farm in carrying milk to a cheese factory as in selling milk, because many dairymen do not use the whey, and in those cases where whey is drawn back to the farm for feeding purposes, its actual value is too small to consider in this connection.

TABLE A—SHOWING AMOUNT OF PROFIT FROM CHEESE.

Breed.	NAME OF COW.	PERIOD OF LACTATION.			
		First.	Second.	Fourth.	Third.
American Holderness.	Maggie 6th .....	*\$1 75	\$4 54	\$5 55	.....
American Holderness.	Nora .....	14 15	.....	.....	.....
Ayrshire .....	Junieta Peerless .....	.....	2 06	18 24	.....
Ayrshire .....	Manton Belle .....	4 91	1 45	9 48	\$11 54
Ayrshire .....	Miss Flow 5th. ....	8 87	13	8 20	4 87
Ayrshire .....	Queen Duchess .....	13 62	11 49	.....	.....
Devon .....	Artalia .....	9 82	.....	.....	.....
Devon .....	Genevie's Gift .....	1 98	6 39	.....	.....
Devon .....	Ione .....	51	*3 42	.....	.....
Guernsey .....	Madame Select .....	.....	17 17	.....	.....
Guernsey .....	Oriole .....	16 75	21 21	.....	.....
Guernsey .....	Rosette Ford .....	9 30	18 78	.....	.....
Guernsey .....	Stella Select .....	0 00	.....	.....	.....
Holstein-Friesian ..	Beauty Pledge .....	.....	16 84	.....	.....
Holstein-Friesian ..	Esel 2d. ....	18 55	.....	.....	.....
Holstein-Friesian ..	Netherland Constance.	12 86	.....	.....	.....
Holstein-Friesian ..	Ruth .....	45	.....	.....	.....
Jersey .....	Albert's Carol .....	2 70	9 85	.....	.....
Jersey .....	Barbara Allen .....	6 50	8 78	31 79	.....
Jersey .....	Countess Flavia .....	12 82	16 66	17 88	29 45
Jersey .....	Gilderbloom .....	5 66	.....	21 07	.....
Shorthorn .....	Betsey 10th. ....	4 42	25 69	.....	.....

\* Loss.

TABLE B—SHOWING AVERAGE AMOUNT OF PROFIT PER COW FROM CHEESE.

BREED.	First period of lactation.	Second period of lactation.	Third period of lactation.	Fourth period of lactation.	Average of all periods of lactation.
American Holderness ..	\$6 20	\$4 54	\$5 55	.....	\$5 62
Ayrshire ..	7 31	8 79	10 81	\$7 96	7 00
Devon ..	4 10	1 51	.....	.....	3 06
Guernsey ..	8 68	19 04	.....	.....	18 87
Holstein-Friesian ..	10 46	16 84	.....	.....	12 62
Jersey ..	6 94	10 11	20 07	29 45	18 42
Shorthorn ..	4 42	25 69	.....	.....	15 06

TABLE C—SHOWING SUMMARY OF AVERAGE AMOUNT OF PROFIT PER COW FROM CHEESE.

BREED.	Number of cows.	Total number of periods of lactation.	Average amount of profit per cow for one period of lactation.	Relative profit.
Devon .....	3	5	\$3 06	100
American Holderness ..	2	4	5 62	184
Ayrshire ..	4	12	7 00	239
Holstein-Friesian ..	4	4	12 02	398
Jersey ..	4	11	13 42	438
Guernsey ..	4	6	18 87	453
Shorthorn ..	1	2	15 06	492

TABLED SUMMARY GIVING COMPARISON OF RESULTS SECURED WITH DIFFERENT BREEDS OF DAIRY CATTLE WITH REFERENCE TO THE PRODUCTION OF CHEESE — AVERAGE PER COW FOR ONE PERIOD (10 MONTHS) OF LACTATION.

	American Holderness.	Ayrshire.	Devon.	Guernsey.	Holstein- Friesian.	Jersey.	Shorthorn.
Number of cows .....	2	4	3	4	4	4	1
Total number of periods of lactation.....	4	12	5	6	4	11	2
Pounds of fat in milk .....	213.1	244.8	183.3	285.5	266.1	282.1	269.0
Pounds of casein in milk .....	139.3	164.7	112.1	155.4	185.0	150.8	172.9
Pounds of green cheese produced.....	592.7	681.1	481.9	709.6	755.2	687.3	728.2
Pounds of cheese made from 100 pounds of milk ..	10.18	9.98	12.10	13.05	9.54	13.62	12.03
Pounds of milk required to make one lb. of cheese.	9.82	10.02	8.27	7.66	10.48	7.34	8.31
Pounds of cheese made for one lb. of fat in milk ..	2.73	2.77	2.63	2.46	2.84	2.43	2.71
Per cent. of fat in cheese.....	36.57	35.95	38.04	40.63	35.24	41.05	36.94
Per cent. of casein in cheese .....	23.90	24.20	23.26	23.12	24.50	21.94	23.74
Per cent. of water, ash, etc., in cheese.....	39.53	39.85	38.70	37.25	40.26	37.06	39.32
Cost of one pound of cheese, in cents .....	7.36	7.24	7.78	6.57	6.72	6.62	6.35
Money value of cheese produced .....	\$56.33	\$65.84	\$46.58	\$67.92	\$73.00	\$66.44	\$70.39
Profit from cheese.....	5 62	7 00	3 06	13 87	12 02	13 42	15 06

FIGURES BASED ON LOWEST RESULTS AS 100.

	American Holderness.	Ayrshire.	Darvon.	Guernsey.	Holstein- Friesian.	Jersey.	Shorthorn.
Relative amount of fat in milk .....	116	134	100	156	145	154	147
Relative amount of casein in milk .....	124	147	100	139	165	185	154
Relative amount of cheese made .....	121	141	100	146	157	143	151
Relative amount of cheese made from 100 lbs of milk.	107	104	127	137	100	143	126
Relative amount of milk required to make cheese...	134	137	113	104	143	100	113
Relative amount of cheese made for milk-fat . . .	112	114	108	101	117	100	111
Relative amount of fat in cheese .....	104	102	108	115	100	116	105
Relative amount of casein in cheese .....	109	110	106	101	112	100	108
Relative amount of water, ash, etc., in cheese .....	107	108	104	101	109	100	106
Relative cost of one pound of cheese .....	116	114	123	103	106	104	100
Relative money value of cheese .....	131	141	100	147	157	143	151
Relative profit from cheese .....	184	229	100	453	393	438	492

## COST OF FOOD EATEN DURING EACH MONTH OF LACTATION.

Breed.	NAME OF COW.	Period of Lactation.	NUMBER OF MONTHS OF LACTATION.										Total cost of food for whole period of lactation.
			First.	Second.	Third.	Fourth.	Fifth.	Sixth.	Seventh.	Eighth.	Ninth.	Tenth.	
American Holderness	Maggie 8th	1	3 70	4 14	4 83	3 95	3 54	3 31	3 34	3 23	3 06	3 03	32 52
American Holderness	Maggie 8th	2	3 09	4 32	4 43	4 76	4 25	3 34	3 04	3 77	3 00	3 04	32 10
American Holderness	Maggie 8th	3	3 27	4 30	4 31	5 06	5 48	5 18	4 86	5 11	3 38	3 14	32 10
American Holderness	Nora	1	3 50	4 17	4 14	5 00	4 30	4 09	3 33	3 33	3 38	3 14	32 10
Ayrshire	Junietta Peeries.	1	3 82	5 15	5 09	5 33	5 04	5 16	5 04	5 34	4 65	4 10	43 40
Ayrshire	Junietta Peeries.	2	3 86	4 17	5 13	5 10	5 33	5 03	5 33	5 13	5 47	4 39	43 40
Ayrshire	Manon Belle.	1	3 83	5 17	5 27	5 01	4 86	5 00	5 23	4 13	5 44	4 32	43 40
Ayrshire	Manon Belle.	2	4 23	5 19	5 19	5 06	5 04	5 30	5 01	4 86	5 47	4 32	43 40
Ayrshire	Manon Belle.	3	0 78	4 33	5 09	5 23	5 30	5 13	4 77	4 06	5 46	4 32	43 40
Ayrshire	Manon Belle.	4	0 83	4 33	4 71	5 02	5 00	4 73	5 02	4 43	5 46	4 32	43 40
Ayrshire	Miss Flow 8th	1	3 39	4 17	4 50	4 02	4 13	4 18	3 56	4 77	4 46	4 10	43 40
Ayrshire	Miss Flow 8th	2	3 13	3 36	4 01	4 03	4 06	4 13	3 50	4 43	4 46	4 10	43 40
Ayrshire	Miss Flow 8th	3	3 13	4 03	4 01	4 03	4 06	4 13	3 50	4 43	4 46	4 10	43 40
Ayrshire	Miss Flow 8th	4	3 07	4 03	4 01	4 03	4 06	4 13	3 50	4 43	4 46	4 10	43 40
Ayrshire	Queen Duchess.	1	3 06	3 36	3 73	3 31	3 59	3 64	3 33	3 57	3 10	3 04	43 40
Ayrshire	Queen Duchess.	2	3 06	3 36	3 73	3 31	3 59	3 64	3 33	3 57	3 10	3 04	43 40
Ayrshire	Queen Duchess.	3	3 12	3 04	3 16	3 21	3 59	3 64	3 33	3 57	3 10	3 04	43 40
Devon	Artale	1	3 70	5 33	3 78	3 34	3 95	4 49	4 34	4 43	4 10	3 50	41 00
Devon	Genevieve's Gift.	1	3 01	3 40	3 01	3 33	3 76	3 15	3 15	4 33	3 27	3 03	41 00
Devon	Genevieve's Gift.	2	4 33	4 66	4 01	3 81	4 15	3 01	3 30	3 30	3 33	3 03	41 00
Devon	Lois	1	3 33	3 52	3 52	3 70	3 59	3 73	3 70	3 30	3 33	3 03	41 00
Devon	Lois	2	3 33	4 46	4 51	5 30	4 30	5 50	4 00	3 00	3 04	3 33	41 00
Guernsey	Madame Select	1	4 12	5 90	5 85	5 17	4 64	5 10	4 73	4 53	3 59	3 04	43 40
Guernsey	Onio	1	3 17	3 63	3 49	4 10	4 34	4 47	4 17	4 34	4 13	3 04	43 40
Guernsey	Onio	2	3 31	5 63	5 70	6 02	4 96	5 00	4 11	4 36	4 03	3 04	43 40
Guernsey	Robert's Ford	1	3 53	3 83	4 60	4 18	4 61	4 85	4 13	3 30	3 30	3 04	43 40
Guernsey	Robert's Ford	2	3 53	5 74	5 87	5 30	5 73	5 33	4 13	3 30	3 30	3 04	43 40
Guernsey	Stella Select.	1	4 10	4 16	4 50	4 00	4 66	4 73	4 46	5 33	5 41	3 04	43 40
Holstein-Friesian	Beauty Pledge	1	3 74	6 06	5 79	6 71	5 33	5 55	4 50	3 70	4 51	3 04	43 40
Holstein-Friesian	Paul M.	1	3 64	5 04	5 67	5 33	5 06	5 51	5 73	5 13	5 00	3 04	43 40
Holstein-Friesian	Netherland Consensus	1	3 54	5 04	5 53	5 01	5 06	5 51	5 00	5 30	5 30	3 04	43 40
Holstein-Friesian	Paul M.	1	3 54	5 04	5 53	5 01	5 06	5 51	5 73	5 13	5 00	3 04	43 40

Jersey .....	1	4 31	5 04	4 33	4 15	4 14	5 00	5 34	5 07	4 63	4 36	46 30
Jersey .....	3	3 19	4 47	4 95	4 61	5 17	4 65	4 67	3 68	3 56	3 59	43 61
Jersey .....	1	3 31	4 46	5 04	4 74	4 80	4 30	4 76	4 35	4 30	4 18	44 10
Jersey .....	3	3 33	4 36	5 11	4 97	4 83	4 47	5 63	5 33	5 44	4 75	46 30
Jersey .....	3	3 47	4 90	5 03	5 54	5 48	5 11	5 33	5 96	5 45	5 30	50 30
Jersey .....	1	4 00	4 49	5 36	4 61	5 19	4 38	4 77	5 38	5 05	5 23	50 00
Jersey .....	3	3 00	4 77	5 25	4 46	4 63	4 60	4 86	4 33	4 87	3 54	45 10
Jersey .....	3	3 40	5 57	5 14	5 16	5 38	5 06	4 61	3 68	3 76	3 02	43 90
Jersey .....	4	3 63	5 14	5 28	4 94	5 78	4 60	4 30	3 90	3 40	3 50	45 07
Jersey .....	1	3 12	4 53	4 84	4 49	4 63	4 55	4 47	3 64	3 88	3 63	41 70
Jersey .....	3	3 49	3 84	4 20	4 53	4 96	4 63	4 74	4 51	5 02	4 27	43 30
Shorthorn .....	1	3 96	3 68	3 45	3 68	3 85	4 09	5 73	6 36	5 88	5 33	44 00
Shorthorn .....	3	3 63	5 75	5 24	6 17	5 33	5 01	4 63	4 46	4 61	3 61	43 45
<hr/>												
Highest monthly cost of food.....		\$6 99	Lowest per day for any single month.....									
Lowest monthly cost of food.....		3 26	Average cost of daily food.....									
Monthly average cost of food.....		4 60										
Highest daily average for period of lactation .....		19.21										
Lowest daily average for period of lactation .....		9.44										
Highest per day for any single month .....		23.3										
<hr/>												
												\$0 07.4
												15½
												Total, \$2,033 76

## POUNDS OF MILK GIVEN DURING EACH MONTH OF LACTATION.

Breed.	NAME OF COW.	Period of lactation.	NUMBER OF MONTHS OF LACTATION.										Pounds of milk for whole lactation.
			First.	Second.	Third.	Fourth.	Fifth.	Sixth.	Seventh.	Eighth.	Ninth.	Tenth.	
American Holderness	Maggie 6th	1	568.5	585.3	532.9	493.3	413.0	449.4	417.1	438.1	407.6	416.9	4708
	Maggie 6th	2	447.3	505.9	594.3	795.1	693.1	607.3	565.0	537.5	446.4	361.6	6113
	Maggie 6th	3	480.3	531.8	546.9	775.0	773.6	695.7	633.0	590.9	393.9	18.7	5005
	Nora	1	540.0	800.1	709.3	760.5	693.4	635.3	538.7	519.6	536.0	457.8	6164
Ayrshire	Junietta Peerless.	2	893.7	963.8	966.1	986.3	719.6	800.5	743.1	675.9	465.3	163.7	7328
	Junietta Peerless.	3	976.5	1065.8	1058.0	923.6	915.5	900.4	874.3	881.1	750.4	485.6	8890
	Manton Belle	1	533.3	649.6	655.4	714.3	688.3	661.5	653.1	637.3	558.7	464.7	6936
	Manton Belle	2	830.4	873.0	843.4	739.6	738.5	747.6	699.5	467.5	359.4	66.1	6314
	Manton Belle	3	1315.1	1170.0	833.5	934.1	850.3	735.1	709.4	857.1	532.3	373.1	8186
	Manton Belle	4	757.0	844.1	946.0	1058.9	850.3	830.8	723.8	701.3	563.3	439.9	7735
	Miss Flow 5th	1	442.4	636.1	573.6	558.0	591.6	534.4	531.7	449.5	431.5	333.9	5123
	Miss Flow 5th	2	541.4	661.7	694.3	664.3	566.3	533.3	453.3	456.3	410.0	346.5	5116
	Miss Flow 5th	3	809.1	905.2	917.6	793.7	715.9	614.0	505.8	383.9	189.3	65.7	6376
	Miss Flow 5th	4	910.5	814.9	708.4	764.0	730.0	671.8	570.4	490.6	390.3	64.0	6051
	Queen Duchess	1	815.7	871.1	701.6	637.3	708.9	747.1	649.0	703.3	663.4	690.6	6991
	Queen Duchess	2	836.6	916.9	901.6	873.3	854.1	835.3	773.6	701.5	418.1	187.1	7390
Devon	Artilla	1	597.1	591.6	598.7	563.6	543.7	555.3	536.7	390.6	341.6	311.1	5014
	Genevieve's Gift.	1	336.0	408.7	333.1	324.3	365.3	277.9	391.7	276.1	265.6	304.9	3049
	Genevieve's Gift.	2	591.4	549.8	437.8	404.3	459.3	443.0	437.3	326.4	326.6	13.5	4007
	Ione	1	408.0	493.9	473.7	437.3	480.4	393.4	328.5	346.0	311.9	386.8	3944
Devon	Ione	2	735.6	746.1	563.8	537.4	459.7	410.1	313.4	135.7	45.3	.....	3904
	Madame Select.	2	564.2	581.7	551.6	499.3	450.9	474.4	442.8	463.1	365.6	386.5	4770
Guernsey	Orle	1	494.1	440.0	476.4	536.3	537.3	531.3	536.3	577.9	560.9	475.3	5392
	Orle	2	533.9	733.8	630.3	661.3	639.5	646.5	561.3	558.9	540.6	530.3	6016
	Rosette Ford	1	390.0	543.4	551.5	468.3	501.9	478.8	515.9	476.1	463.7	482.0	4896
	Rosette Ford.	2	608.6	1019.3	918.5	880.0	874.3	533.9	484.9	430.5	304.7	356.5	6113
	Stella Select.	1	743.0	633.6	603.4	610.9	616.0	556.0	397.7	432.7	333.3	394.7	5335
Holstein-Friesian	Beauty Pledge	2	760.0	1197.4	1319.0	1364.5	1155.8	994.0	793.0	563.9	466.4	170.9	8660
	Keel Rd.	1	651.0	894.0	895.0	780.6	760.5	735.1	700.1	605.8	638.1	544.7	7315
	Netherland Constance	1	739.0	1080.3	1168.1	1060.5	990.3	937.5	947.8	809.5	759.1	948.5	9435
	Erith	1	877.3	941.4	796.9	849.0	699.5	633.3	536.4	430.4	356.3	336.5	6386
Jersey	Albert's Carol	1	605.6	553.6	554.0	469.7	433.6	438.0	433.3	434.6	469.9	374.4	4794
	Albert's Carol.	2	493.3	533.1	505.0	505.7	536.4	463.1	473.3	399.5	315.7	164.8	4383

Jersey .....	1	519.0	501.7	494.2	450.6	496.2	409.9	437.4	418.1	421.7	468.3	4616
Jersey .....	2	560.0	680.8	648.0	633.8	543.4	469.7	490.6	436.2	374.9	356.7	5176
Jersey .....	3	731.6	794.3	763.2	667.6	786.9	694.5	672.2	567.5	541.1	406.4	64.8
Jersey .....	1	430.7	627.7	614.5	580.5	574.0	493.4	474.1	443.7	448.9	446.8	5185
Jersey .....	2	404.5	730.8	616.8	506.7	504.1	491.1	506.7	453.9	453.3	349.8	50.8
Jersey .....	3	515.0	639.7	560.5	477.1	531.4	496.4	479.8	396.6	363.2	248.6	4698
Jersey .....	4	570.0	731.8	696.9	635.6	663.6	595.3	572.5	433.5	413.0	381.2	5715
Jersey .....	1	486.0	535.6	473.8	410.7	438.4	343.3	343.0	307.1	356.8	316.5	4000
Jersey .....	2	567.0	732.0	630.7	638.1	609.3	611.7	537.0	467.4	496.3	376.5	5644
Shorthorn .....	1	636.2	637.1	650.6	531.6	435.5	433.7	437.8	445.2	411.8	360.4	5019
Shorthorn .....	2	886.6	941.1	783.9	836.6	668.0	652.3	564.2	537.9	596.6	530.0	7091
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			Pounds									
Average monthly yield of all .....			580	Pounds								
Highest monthly yield .....			1,364.5	Highest per day for any one month.....								
Lowest monthly yield .....			81.1	Lowest per day for any one month.....								
Highest daily average for lactation period .....			10.0	Average daily yield.....								
Lowest daily average for lactation period .....				Total pounds milk produced.....								
				<hr/>								
				266,160								

## COST OF ONE QUART OF MILK DURING EACH MONTH OF LACTATION.

Breed.	NAME OF COW.	Period of lactation.	NUMBER OF MONTH OF LACTATION.										Average cost of one quart of milk during whole period of lactation.
			First.	Second.	Third.	Fourth.	Fifth.	Sixth.	Seventh.	Eighth.	Ninth.	Tenth.	
American Holderness	Maggie 6th.	1	Cent. 1.40	Cent. 1.74	Cent. 1.76	Cent. 1.71	Cent. 1.86	Cent. 1.86	Cent. 1.86	Cent. 1.86	Cent. 1.86	Cent. 1.87	Cent. 1.73
American Holderness	Maggie 6th.	2	Cent. 1.80	Cent. 1.14	Cent. 1.08	Cent. 1.34	Cent. 1.57	Cent. 1.96	Cent. 2.14	Cent. 2.14	Cent. 1.80	Cent. 3.94	Cent. 1.66
American Holderness	Maggie 6th.	3	Cent. 1.15	Cent. 1.09	Cent. 1.84	Cent. 1.73	Cent. 1.73	Cent. 1.63	Cent. 1.63	Cent. 1.63	Cent. 1.54	Cent. 40.80	Cent. 1.74
American Holderness	Nora	1	Cent. 1.00	Cent. 1.11	Cent. 1.95	Cent. 1.83	Cent. 1.36	Cent. 1.40	Cent. 1.46	Cent. 1.36	Cent. 1.36	Cent. 1.33	Cent. 1.33
Ayrshire	Junietta Peerless.	3	Cent. 0.91	Cent. 1.15	Cent. 1.11	Cent. 1.30	Cent. 1.37	Cent. 1.64	Cent. 1.75	Cent. 1.56	Cent. 2.15	Cent. 5.06	Cent. 1.50
Ayrshire	Junietta Peerless.	3	Cent. 0.74	Cent. 0.91	Cent. 1.04	Cent. 1.42	Cent. 1.37	Cent. 1.50	Cent. 1.39	Cent. 1.49	Cent. 1.57	Cent. 3.23	Cent. 1.37
Ayrshire	Manton Belle.	1	Cent. 1.14	Cent. 1.13	Cent. 1.51	Cent. 1.51	Cent. 1.51	Cent. 1.50	Cent. 1.43	Cent. 1.46	Cent. 1.45	Cent. 3.03	Cent. 1.45
Ayrshire	Manton Belle.	3	Cent. 1.11	Cent. 1.25	Cent. 1.31	Cent. 1.63	Cent. 1.70	Cent. 1.54	Cent. 1.73	Cent. 2.33	Cent. 2.33	Cent. 13.40	Cent. 1.73
Ayrshire	Manton Belle.	3	Cent. 1.11	Cent. 1.36	Cent. 1.40	Cent. 1.45	Cent. 1.54	Cent. 1.68	Cent. 1.73	Cent. 1.65	Cent. 2.36	Cent. 2.72	Cent. 1.54
Ayrshire	Manton Belle.	4	Cent. 1.33	Cent. 1.07	Cent. 1.15	Cent. 1.15	Cent. 1.23	Cent. 1.35	Cent. 1.48	Cent. 1.24	Cent. 1.60	Cent. 1.93	Cent. 1.33
Ayrshire	Miss Flow 5th.	1	Cent. 1.12	Cent. 1.43	Cent. 1.76	Cent. 2.06	Cent. 2.54	Cent. 1.90	Cent. 2.06	Cent. 2.33	Cent. 2.33	Cent. 3.36	Cent. 2.03
Ayrshire	Miss Flow 5th.	3	Cent. 0.91	Cent. 1.23	Cent. 1.45	Cent. 1.44	Cent. 1.67	Cent. 1.67	Cent. 1.93	Cent. 2.35	Cent. 2.44	Cent. 2.98	Cent. 1.70
Ayrshire	Miss Flow 5th.	3	Cent. 0.83	Cent. 1.05	Cent. 1.18	Cent. 1.43	Cent. 1.56	Cent. 1.86	Cent. 2.17	Cent. 2.53	Cent. 2.85	Cent. 4.95	Cent. 1.66
Ayrshire	Miss Flow 5th.	4	Cent. 0.91	Cent. 1.30	Cent. 1.35	Cent. 1.73	Cent. 1.87	Cent. 1.85	Cent. 2.02	Cent. 2.57	Cent. 3.06	Cent. 3.40	Cent. 1.83
Ayrshire	Queen Duchess.	1	Cent. 1.00	Cent. 1.26	Cent. 1.45	Cent. 1.70	Cent. 1.53	Cent. 1.55	Cent. 1.60	Cent. 1.64	Cent. 1.67	Cent. 1.64	Cent. 1.51
Ayrshire	Queen Duchess.	2	Cent. 0.51	Cent. 1.18	Cent. 1.83	Cent. 1.27	Cent. 1.40	Cent. 1.52	Cent. 1.54	Cent. 1.73	Cent. 2.46	Cent. 5.13	Cent. 1.45
Devon	Artala	1	Cent. 1.35	Cent. 1.28	Cent. 1.39	Cent. 1.50	Cent. 1.55	Cent. 1.74	Cent. 1.96	Cent. 2.35	Cent. 2.58	Cent. 3.45	Cent. 1.70
Devon	Generie's Gift.	1	Cent. 1.84	Cent. 1.28	Cent. 1.63	Cent. 1.90	Cent. 2.34	Cent. 2.44	Cent. 2.79	Cent. 2.85	Cent. 2.55	Cent. 2.46	Cent. 2.08
Devon	Generie's Gift.	3	Cent. 1.57	Cent. 1.68	Cent. 2.15	Cent. 2.08	Cent. 1.94	Cent. 1.90	Cent. 1.96	Cent. 2.00	Cent. 2.71	Cent. 3.44	Cent. 2.06
Devon	Ione.	1	Cent. 1.28	Cent. 1.62	Cent. 1.73	Cent. 1.73	Cent. 1.81	Cent. 2.03	Cent. 2.45	Cent. 1.99	Cent. 2.93	Cent. 3.80	Cent. 1.96
Devon	Ione	3	Cent. 1.07	Cent. 1.26	Cent. 1.72	Cent. 2.16	Cent. 2.30	Cent. 2.91	Cent. 3.31	Cent. 5.70	Cent. 14.50	.....	Cent. 2.20
Guernsey	Madame Select.	3	Cent. 1.57	Cent. 2.14	Cent. 2.28	Cent. 2.33	Cent. 2.37	Cent. 2.31	Cent. 1.81	Cent. 2.10	Cent. 2.00	Cent. 2.00	Cent. 2.13
Guernsey	Orlone	1	Cent. 1.07	Cent. 1.23	Cent. 1.57	Cent. 1.80	Cent. 1.67	Cent. 1.65	Cent. 1.60	Cent. 1.57	Cent. 1.87	Cent. 1.83	Cent. 1.53
Guernsey	Orlone	3	Cent. 1.33	Cent. 1.45	Cent. 1.95	Cent. 1.96	Cent. 1.70	Cent. 1.68	Cent. 1.57	Cent. 1.68	Cent. 1.96	Cent. 1.64	Cent. 1.73
Guernsey	Rosette Ford	1	Cent. 1.55	Cent. 1.51	Cent. 1.77	Cent. 1.85	Cent. 1.97	Cent. 2.18	Cent. 1.90	Cent. 1.90	Cent. 1.49	Cent. 1.96	Cent. 1.80
Guernsey	Rosette Ford	3	Cent. 1.21	Cent. 1.33	Cent. 1.83	Cent. 1.54	Cent. 1.83	Cent. 2.15	Cent. 2.41	Cent. 2.72	Cent. 2.85	Cent. 4.00	Cent. 1.93
Guernsey	Stella Select.	1	Cent. 1.19	Cent. 1.41	Cent. 1.57	Cent. 1.60	Cent. 1.63	Cent. 1.92	Cent. 2.11	Cent. 2.73	Cent. 3.04	Cent. 3.04	Cent. 1.91
Holstein-Friesian	Beauty Pledge	3	Cent. 1.07	Cent. 1.09	Cent. 1.02	Cent. 1.06	Cent. 1.10	Cent. 1.20	Cent. 1.30	Cent. 1.56	Cent. 2.38	Cent. 7.95	Cent. 1.35
Holstein-Friesian	Ezel 2d	1	Cent. 1.20	Cent. 1.27	Cent. 1.36	Cent. 1.60	Cent. 1.45	Cent. 1.72	Cent. 1.56	Cent. 1.68	Cent. 1.77	Cent. 2.16	Cent. 1.55

Holstein-Friesian .....	1	1.54	1.17	1.30	1.39	1.40	1.33	1.36	1.47	1.30	1.30
Holstein-Friesian .....	1	0.96	1.26	1.39	1.43	1.44	1.46	1.59	2.03	2.21	1.45
Netherland Constance .....											
Ruth .....											
Jersey .....	1	1.50	1.95	1.68	1.90	2.01	2.05	2.50	2.31	1.43	2.10
Jersey .....	2	1.64	1.76	1.88	1.96	2.06	2.13	2.23	2.43	4.10	2.09
Jersey .....	1	1.37	1.91	2.19	1.60	2.03	2.36	2.34	2.15	1.93	2.05
Jersey .....	2	1.24	1.87	1.70	1.68	1.91	2.08	2.47	2.13	2.36	2.00
Jersey .....	3	1.03	1.35	1.43	1.78	1.61	1.76	2.02	2.17	2.06	1.68
Jersey .....	1	2.09	1.51	2.19	1.71	1.94	2.15	2.61	2.43	2.50	2.10
Jersey .....	2	1.59	1.43	1.80	1.90	1.93	2.01	2.06	2.31	2.36	1.90
Jersey .....	3	1.43	1.90	1.97	2.32	2.23	2.19	2.06	2.07	1.63	2.01
Jersey .....	4	1.37	1.51	1.62	1.70	1.79	1.66	1.84	1.77	1.98	1.69
Jersey .....	1	1.33	1.81	2.19	2.35	2.33	2.35	2.55	2.30	2.46	2.24
Jersey .....	3	0.91	1.14	1.46	1.55	1.75	1.65	2.18	2.13	2.45	1.65
Shorthorn .....	1	1.03	1.30	1.14	1.50	1.93	2.01	2.81	2.03	3.09	1.89
Shorthorn .....	2	0.83	1.31	1.44	1.60	1.61	1.65	1.61	1.66	1.46	1.47

Cent.

Average of all, per pound .....	0.79
Average of all, per quart .....	1.70

## COST OF ONE POUND OF MILK DURING EACH MONTH OF LACTATION.

Breed.	NAME OF COW.	Period of lactation.	NUMBER OF MONTH OF LACTATION.										Average cost of whole period of lactation. Pounds of milk for 100
			First.	Second.	Third.	Fourth.	Fifth.	Sixth.	Seventh.	Eighth.	Ninth.	Tenth.	
			Cents.	Cents.	Cents.	Cents.	Cents.	Cents.	Cents.	Cents.	Cents.	Cents.	Cents.
American Holderness	Maggie 6th	1	0.65	0.81	0.83	0.81	0.86	0.97	0.87	0.89	0.90	0.87	0.83
American Holderness	Maggie 6th	2	0.60	0.53	0.45	0.62	0.73	0.87	0.99	1.07	0.84	1.51	0.77
American Holderness	Maggie 6th	3	0.54	0.51	0.63	0.75	0.81	0.76	0.77	0.97	1.91	19.00	0.81
American Holderness	Nora	1	0.46	0.52	0.53	0.64	0.64	0.65	0.69	0.63	0.73	0.64	0.61
Ayrshire	Junietta Peerless	2	0.43	0.53	0.53	0.60	0.64	0.76	0.80	0.85	1.00	2.35	0.70
Ayrshire	Junietta Peerless	3	0.34	0.42	0.43	0.65	0.59	0.50	0.65	0.69	0.73	1.03	0.59
Ayrshire	Manton Belle	1	0.53	0.53	0.55	0.70	0.70	0.70	0.66	0.68	0.73	1.03	0.67
Ayrshire	Manton Belle	2	0.53	0.60	0.61	0.75	0.80	0.73	0.80	1.04	1.82	6.32	0.80
Ayrshire	Manton Belle	3	0.53	0.59	0.65	0.67	0.73	0.78	0.80	0.77	1.03	1.93	0.73
Ayrshire	Manton Belle	4	0.53	0.50	0.54	0.63	0.63	0.63	0.69	0.61	0.79	0.90	0.63
Ayrshire	Miss Flow 5th	1	0.53	0.67	0.53	0.93	1.18	0.88	0.96	1.04	1.11	1.56	0.94
Ayrshire	Miss Flow 5th	2	0.43	0.57	0.67	0.67	0.73	0.78	0.80	1.06	1.14	1.98	0.79
Ayrshire	Miss Flow 5th	3	0.39	0.49	0.55	0.67	0.67	0.73	1.01	1.30	1.82	2.80	0.77
Ayrshire	Miss Flow 5th	4	0.43	0.60	0.63	0.80	0.73	0.84	0.94	1.29	1.80	6.32	0.85
Ayrshire	Queen Duchess	1	0.51	0.60	0.63	0.74	0.71	0.73	0.74	0.76	0.78	0.70	0.70
Ayrshire	Queen Duchess	2	0.34	0.15	0.50	0.59	0.65	0.71	0.73	0.80	1.14	3.40	0.67
Devon	Artalia	1	0.63	0.60	0.64	0.70	0.73	0.81	0.92	1.11	1.30	1.60	0.83
Devon	Genevieve's Gift	1	0.63	0.60	0.76	0.88	1.00	1.14	1.30	1.10	1.19	1.15	0.94
Devon	Genevieve's Gift	2	0.73	0.85	0.99	0.94	0.90	0.88	0.91	0.93	1.23	1.14	0.87
Devon	Ione	1	0.60	0.75	0.83	0.81	0.84	0.90	1.12	0.92	1.36	1.30	0.93
Devon	Ione	2	0.50	0.60	0.81	1.00	1.07	1.35	1.50	2.65	6.74	.....	1.06
Guernsey	Madame Select	2	0.73	1.00	1.06	1.04	1.10	1.07	0.84	0.98	0.93	0.83	0.99
Guernsey	Ortolo	1	0.50	0.60	0.73	0.80	0.77	0.77	0.74	0.78	0.74	0.86	0.73
Guernsey	Ortolo	2	0.61	0.77	0.97	0.97	0.79	0.77	0.73	0.78	0.97	0.76	0.90
Guernsey	Rosette Ford	1	0.72	0.70	0.83	0.86	0.91	1.01	0.88	0.88	0.69	0.91	0.94
Guernsey	Rosette Ford	2	0.56	0.56	0.64	0.71	0.80	1.00	1.45	1.36	1.79	1.86	0.90
Guernsey	Stella Select	1	0.53	0.66	0.73	0.74	0.76	0.89	1.13	1.36	1.41	1.41	0.89
Holstein-Friesian	Beauty Pledge	2	0.50	0.51	0.46	0.49	0.51	0.56	0.61	0.73	1.05	1.70	0.93
Holstein-Friesian	Ezel 2d	1	0.56	0.60	0.63	0.74	0.67	0.80	0.73	0.78	0.80	1.00	0.73
Holstein-Friesian	Netherland Constance	1	0.73	0.54	0.56	0.56	0.60	0.65	0.61	0.60	0.63	0.60	0.60
Holstein-Friesian	Ruth	1	0.44	0.58	0.64	0.70	0.67	0.66	0.69	0.50	1.13	1.03	0.63

Jersey .....	1	0.70	0.91	0.75	0.89	0.93	0.96	1.23	1.16	1.07	0.66	0.96
Jersey .....	3	0.75	0.83	0.88	0.91	0.96	0.96	0.98	1.01	1.13	1.90	0.97
Jersey .....	1	0.64	0.80	1.08	0.74	0.97	1.05	1.09	1.04	1.00	0.89	0.86
Jersey .....	3	0.58	0.64	0.79	0.78	0.89	0.97	1.15	1.15	1.45	1.33	0.93
Jersey .....	3	0.47	0.63	0.87	0.83	0.75	0.94	0.94	1.01	1.01	0.96	0.78
Jersey .....	1	0.97	0.73	1.08	0.75	0.90	1.00	1.00	1.31	1.19	1.16	0.98
Jersey .....	3	0.74	0.66	0.84	0.88	0.93	0.96	0.96	1.05	1.07	1.10	0.83
Jersey .....	3	0.66	0.86	0.93	1.06	1.03	1.03	0.95	0.96	0.75	1.31	0.83
Jersey .....	4	0.64	0.70	0.75	0.79	0.84	0.77	0.85	0.90	0.83	0.83	0.79
Jersey .....	1	0.61	0.84	1.03	1.09	1.06	1.33	1.30	1.30	1.07	1.13	1.04
Jersey .....	3	0.44	0.53	0.66	0.73	0.81	0.77	0.88	0.97	1.01	1.13	0.77
Jersey .....	1	0.48	0.56	0.73	0.70	0.93	0.93	1.33	1.40	1.40	1.44	0.83
Jersey .....	3	0.41	0.51	0.67	0.75	0.77	0.77	0.80	0.75	0.77	0.66	0.83
Jersey .....	1	0.70	0.91	0.75	0.89	0.93	0.96	1.23	1.16	1.07	0.66	0.96
Jersey .....	3	0.64	0.80	1.08	0.74	0.97	1.05	1.09	1.04	1.00	0.89	0.86
Jersey .....	3	0.58	0.64	0.79	0.78	0.89	0.97	1.15	1.15	1.45	1.33	0.93
Jersey .....	3	0.47	0.63	0.87	0.83	0.75	0.94	0.94	1.01	1.01	0.96	0.78
Jersey .....	1	0.97	0.73	1.08	0.75	0.90	1.00	1.00	1.31	1.19	1.16	0.98
Jersey .....	3	0.74	0.66	0.84	0.88	0.93	0.96	0.96	1.05	1.07	1.10	0.83
Jersey .....	3	0.66	0.86	0.93	1.06	1.03	1.03	0.95	0.96	0.75	1.31	0.83
Jersey .....	4	0.64	0.70	0.75	0.79	0.84	0.77	0.85	0.90	0.83	0.83	0.79
Jersey .....	1	0.61	0.84	1.03	1.09	1.06	1.33	1.30	1.30	1.07	1.13	1.04
Jersey .....	3	0.44	0.53	0.66	0.73	0.81	0.77	0.88	0.97	1.01	1.13	0.77
Jersey .....	1	0.48	0.56	0.73	0.70	0.93	0.93	1.33	1.40	1.40	1.44	0.83
Jersey .....	3	0.41	0.51	0.67	0.75	0.77	0.77	0.80	0.75	0.77	0.66	0.83

## POUNDS OF MILK-SOLIDS PRODUCED DURING EACH MONTH OF LACTATION.

Breed.	NAME OF COW.	Period of lactation.	NUMBER OF MONTH OF LACTATION.										Pounds of milk-solids for whole period of lactation.
			First.	Second.	Third.	Fourth.	Fifth.	Sixth.	Seventh.	Eighth.	Ninth.	Tenth.	
American Holderness.	Maggie 6th	1	60.5	69.2	63.3	61.5	51.1	57.8	51.7	53.2	50.9	59.4	579.6
American Holderness.	Maggie 6th	2	57.8	130.5	112.6	96.3	76.0	77.0	74.6	70.9	61.0	41.0	786.7
American Holderness.	Maggie 6th	3	65.1	104.1	102.1	97.1	98.1	88.8	84.0	79.0	41.1	3.1	762.5
American Holderness.	Nora	1	76.3	100.1	85.5	94.2	61.1	76.7	63.0	63.7	67.1	59.8	707.5
Ayrshire.	Junietta Peeries.	1	116.9	116.3	113.3	101.7	92.4	97.5	91.9	88.1	81.9	82.4	902.4
Ayrshire.	Junietta Peeries.	2	127.3	115.9	119.0	106.7	110.1	113.2	103.3	111.3	93.2	63.3	1073.3
Ayrshire.	Manon Belle.	1	70.9	76.2	77.3	90.0	86.7	83.3	77.0	79.7	73.5	60.7	773.3
Ayrshire.	Manon Belle.	2	123.2	113.8	113.4	99.6	96.2	85.4	88.6	69.8	84.0	9.0	886.1
Ayrshire.	Manon Belle.	3	130.6	143.8	103.8	114.3	103.4	99.0	86.3	75.8	61.7	43.6	1011.3
Ayrshire.	Manon Belle.	4	103.0	103.7	111.2	124.4	93.1	83.9	86.4	82.9	62.9	83.0	980.5
Ayrshire.	Miss Flow 5th	1	65.7	81.8	75.3	77.5	70.3	71.1	71.4	64.4	60.2	59.0	666.7
Ayrshire.	Miss Flow 5th	2	71.5	89.2	76.5	74.2	70.8	71.5	61.2	63.6	57.4	43.9	661.3
Ayrshire.	Miss Flow 5th	3	110.0	114.9	109.0	101.5	88.0	86.9	74.5	72.0	55.4	36.2	768.0
Ayrshire.	Miss Flow 5th	4	116.4	102.2	101.0	94.3	91.0	89.5	77.2	62.6	40.8	9.3	788.2
Ayrshire.	Queen Duchess	1	109.2	89.3	85.9	85.3	81.0	100.9	86.2	94.3	87.0	81.1	927.2
Ayrshire.	Queen Duchess	2	117.3	119.6	111.7	117.3	113.2	103.8	101.1	96.9	89.5	32.0	972.3
Devon	Artalia	1	88.9	84.1	85.1	81.8	80.2	81.6	76.3	57.3	47.9	45.6	731.8
Devon	Genevieve's Gift	1	40.5	51.1	51.3	46.3	34.3	36.6	40.3	45.3	40.4	45.8	442.9
Devon	Genevieve's Gift	2	81.0	80.9	70.9	69.3	66.6	64.8	64.9	53.3	30.4	8.9	581.9
Devon	Genevieve's Gift	3	53.3	57.6	63.1	51.3	63.8	54.7	47.3	51.2	48.1	50.4	536.1
Devon	Genevieve's Gift	4	103.1	102.7	76.0	75.8	68.0	61.1	46.3	21.7	6.3	.....	584.4
Guernsey	Madame Select.	1	83.6	94.4	95.1	88.4	73.1	79.0	70.1	74.6	58.1	62.2	773.6
Guernsey	Orfide	1	60.3	66.8	63.9	57.7	72.1	83.1	79.9	81.9	83.5	71.8	745.8
Guernsey	Orfide	2	76.8	106.7	93.4	69.0	65.3	66.1	53.1	61.9	77.8	70.4	837.2
Guernsey	Rosette Ford	1	57.7	73.6	73.8	69.5	53.3	70.9	74.6	69.2	64.9	47.6	701.4
Guernsey	Rosette Ford	2	99.3	146.9	133.3	135.7	103.3	87.3	71.5	74.5	63.9	49.0	940.3
Guernsey	Stella Select.	1	99.9	86.0	80.0	83.1	82.7	74.0	57.9	65.6	62.7	64.6	785.5
Holstein-Friesian	Beauty Pledge	1	99.0	151.0	140.9	160.0	131.4	115.4	91.4	65.3	55.9	37.0	1,036.9
Holstein-Friesian	East 2d	1	87.7	103.9	109.7	97.5	94.7	103.7	103.7	97.3	88.1	73.1	949.4
Holstein-Friesian	Netherland Constance	1	83.6	107.7	127.5	119.4	106.6	115.1	107.9	102.8	88.9	95.3	1,043.0
Holstein-Friesian	Ruth	1	93.1	100.0	84.8	93.7	76.0	71.0	60.4	50.0	41.9	36.7	697.6

Jersey	1	78.8	78.8	77.7	66.7	68.5	66.0	73.7	73.2	72.7	64.0	714.6
Jersey	2	61.9	84.0	84.3	78.9	84.4	78.8	73.4	58.5	51.0	58.1	485.1
Jersey	1	79.8	71.4	70.5	68.6	77.9	68.0	66.9	63.8	63.5	69.5	485.1
Jersey	2	84.6	103.4	9.9	91.9	77.5	68.1	74.6	68.9	63.4	61.1	759.8
Jersey	3	98.4	110.7	110.6	92.8	103.5	96.2	90.2	68.7	81.1	65.8	917.0
Jersey	1	63.1	89.9	91.6	86.5	86.0	79.5	78.3	72.6	74.0	73.6	734.1
Jersey	2	65.0	115.6	103.6	84.3	87.7	83.3	84.7	71.0	73.1	60.0	527.3
Jersey	3	83.0	102.9	93.0	78.8	83.9	80.0	77.3	63.6	67.5	39.8	757.8
Jersey	4	85.5	113.4	113.8	98.5	110.0	81.4	94.3	71.3	65.0	59.0	891.1
Jersey	1	78.3	79.8	78.7	63.9	66.4	52.1	53.6	47.5	53.9	47.4	818.6
Jersey	3	84.1	100.8	93.0	91.8	60.1	89.7	80.4	74.6	75.8	57.4	884.5
Shorthorn	1	92.8	98.9	89.2	71.1	68.2	6.3	61.7	55.9	61.3	67.7	734.0
Shorthorn	2	132.2	130.9	111.0	119.3	100.8	94.6	83.7	64.9	85.2	75.8	1068.4

Pounds.

Highest average monthly yield.....	180.60
Average monthly for all.....	79.66
Highest daily average for lactation period.....	3.50
Lowest daily average for lactation period.....	1.46
Highest average per day for any single month.....	5.80
Total pounds months produced.....	85,048.00

## PER CENT. OF SOLIDS IN MILK DURING EACH MONTH OF LACTATION.

Breed.	NAME OF COW.	Period of lactation.	NUMBER OF MONTH OF LACTATION.										Average per cent. of solids in milk for whole period of lactation.
			First.	Second.	Third.	Fourth.	Fifth.	Sixth.	Seventh.	Eighth.	Ninth.	Tenth.	
American Holderness	Maggie 6th	1	14.44	12.83	11.82	12.11	12.45	12.88	12.95	12.40	12.90	12.50	12.85
American Holderness	Maggie 6th	2	12.93	12.80	12.05	12.14	12.82	12.88	12.95	12.90	12.65	12.87	12.87
American Holderness	Maggie 6th	3	12.85	12.51	12.05	12.13	12.68	12.77	12.77	12.61	12.40	12.60	12.92
American Holderness	Kora	1	14.13	12.37	12.05	12.07	12.36	12.47	12.08	12.35	12.53	12.07	12.45
Ayrshire	Junietta Peerless	2	12.71	12.12	11.73	11.73	11.70	12.04	12.30	12.08	12.31	12.20	12.26
Ayrshire	Junietta Peerless	3	12.58	11.96	11.95	11.66	11.53	12.11	12.40	12.53	12.00	12.53	12.11
Ayrshire	Manion Belle	1	12.82	11.58	11.80	12.60	12.59	12.30	11.82	12.13	12.49	12.00	12.28
Ayrshire	Manion Belle	2	14.01	12.05	12.44	12.46	12.30	12.30	12.31	12.60	12.10	12.59	12.94
Ayrshire	Manion Belle	3	12.73	12.20	12.47	12.37	12.16	12.61	12.03	11.81	11.73	12.43	12.43
Ayrshire	Manion Belle	4	12.09	12.26	11.76	11.75	11.66	11.80	11.94	11.82	12.26	12.34	12.05
Ayrshire	Miss Flow 6th	1	14.85	12.05	12.13	12.15	12.23	12.31	12.31	12.33	12.05	12.96	12.96
Ayrshire	Miss Flow 6th	2	12.80	11.72	12.10	12.37	12.51	12.41	12.54	12.44	12.40	12.86	12.95
Ayrshire	Miss Flow 6th	3	12.50	12.60	11.83	12.31	12.73	12.54	12.44	12.35	12.41	12.91	12.15
Ayrshire	Miss Flow 6th	4	12.70	12.54	12.65	12.50	12.64	12.33	12.54	12.07	12.05	12.46	12.95
Ayrshire	Queen Duchess	1	12.51	12.55	12.31	12.67	12.97	12.47	12.45	12.59	12.43	12.13	12.26
Ayrshire	Queen Duchess	2	12.38	12.05	12.03	12.44	12.25	12.19	12.03	12.65	12.33	12.97	12.33
Devon	Artalia	1	15.53	15.15	14.21	14.46	14.53	14.63	15.23	14.50	14.25	14.08	14.59
Devon	Genieve's Gift	1	12.41	12.65	12.27	12.03	12.44	12.60	12.70	12.70	12.07	12.95	12.53
Devon	Genieve's Gift	2	12.60	15.13	15.40	14.78	14.49	14.55	14.55	14.35	15.24	16.98	14.77
Devon	Ione	1	12.73	12.26	12.32	12.43	12.65	12.44	14.62	14.34	15.43	15.33	14.70
Devon	Ione	2	14.03	12.74	12.48	14.66	14.35	14.90	15.33	15.09	14.90	.....	14.46
Guernsey	Madame Select	2	15.69	16.23	17.24	16.71	17.26	16.61	15.95	16.11	15.07	16.09	16.32
Guernsey	Ortolo	1	15.94	12.83	12.91	12.75	14.07	14.33	14.30	14.18	14.89	15.11	14.34
Guernsey	Ortolo	2	14.66	14.41	14.64	15.07	14.58	15.18	14.61	14.47	14.40	14.98	14.74
Guernsey	Rosette Ford	1	14.70	14.63	14.84	14.30	14.60	14.65	14.40	14.54	14.27	14.95	14.70
Guernsey	Rosette Ford	2	14.22	14.41	14.51	15.33	16.11	16.39	16.53	17.23	17.45	16.51	15.53
Guernsey	Stella Select	1	12.74	12.45	12.51	12.33	12.61	12.45	14.07	12.67	15.53	16.59	14.13
Holstein-Friesian	Beauty Pledge	2	12.20	12.61	11.50	11.73	11.87	11.61	11.53	12.63	12.19	15.79	12.11
Holstein-Friesian	Keel rd	1	12.47	10.96	12.05	12.36	12.68	12.92	12.92	12.32	12.81	14.33	12.96
Holstein-Friesian	Netherland Constance	1	11.26	10.96	10.93	11.36	11.31	11.53	11.38	11.33	10.60	11.60	11.33
Holstein-Friesian	Ruth	1	10.64	10.63	10.65	10.93	10.93	11.31	11.23	11.63	11.76	11.77	11.00

Jersey	.....	Albert's Carol	.....	1	13.53	14.33	14.03	14.30	14.64	15.05	17.06	16.90	17.10	15.13
Jersey	.....	Albert's Carol	.....	2	14.66	15.61	15.63	15.61	15.67	15.77	15.73	15.83	15.16	15.68
Jersey	.....	Barbara Allen	.....	1	14.03	14.36	14.35	15.28	15.33	15.37	15.33	14.91	15.14	15.62
Jersey	.....	Barbara Allen	.....	2	15.10	14.90	14.35	14.50	14.98	14.73	15.33	15.91	14.64	14.87
Jersey	.....	Barbara Allen	.....	3	13.18	13.94	14.51	13.01	14.31	15.41	15.77	15.95	17.14	13.10
Jersey	.....	Countess Flavia	.....	1	14.90	14.33	14.51	14.90	14.81	15.15	15.50	15.10	16.31	14.76
Jersey	.....	Countess Flavia	.....	2	16.06	16.04	15.53	16.64	17.40	16.93	16.71	16.44	15.90	15.50
Jersey	.....	Countess Flavia	.....	3	16.13	16.34	16.80	16.03	16.09	16.11	16.13	15.89	17.16	16.43
Jersey	.....	Countess Flavia	.....	4	15.03	15.36	16.36	15.74	15.87	15.35	16.46	16.43	15.92	16.16
Jersey	.....	Gilderbloom	.....	1	15.70	14.90	14.50	15.56	15.51	15.19	15.66	15.46	15.47	15.50
Jersey	.....	Gilderbloom	.....	3	14.88	13.93	14.19	14.38	14.79	14.47	14.97	15.33	15.39	14.73
Shorthorn	.....	Betsy 10th	.....	1	14.88	14.40	13.73	13.37	13.69	14.35	14.75	15.30	15.37	14.43
Shorthorn	.....	Betsy 10th	.....	2	13.75	13.01	14.18	14.44	14.55	14.51	14.33	14.30	14.36	14.32
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Highest monthly average per cent.														
Highest for lactation period														
Average for all														
													17.45	
													16.46	
													13.70	

## COST OF ONE POUND OF MILK-SOLIDS DURING EACH MONTH OF LACTATION.

Breed.	NAME OF COW.	Period of lactation.	NUMBER OF MONTH OF LACTATION.										Average cost of 1 lb. of milk-solids for whole period of lactation.
			First.	Second.	Third.	Fourth.	Fifth.	Sixth.	Seventh.	Eighth.	Ninth.	Tenth.	
American Holderness	Maggie 6th	1	Cent. 4.59	Cent. 6.85	Cent. 6.76	Cent. 6.46	Cent. 6.38	Cent. 6.90	Cent. 7.04	Cent. 7.92	Cent. 7.19	Cent. 6.92	Cent. 6.71
American Holderness	Maggie 6th	2	4.65	4.10	5.08	5.00	6.00	6.80	7.54	8.14	8.30	10.84	6.70
American Holderness	Maggie 6th	3	3.95	4.08	5.16	6.08	5.53	5.98	5.77	7.10	19.38	114.50	6.23
American Holderness	Nora	1	3.88	4.18	4.84	5.81	5.18	5.38	5.77	6.15	5.74	4.90	4.93
Ayrshire	Junietta Peerless	8	3.10	4.43	4.41	5.19	5.45	6.32	6.57	6.83	7.51	18.30	5.64
Ayrshire	Junietta Peerless	9	3.16	3.78	4.31	5.73	5.11	4.96	5.18	5.50	5.88	7.95	4.88
Ayrshire	Manton Belle	1	3.98	4.48	5.53	5.57	5.60	5.15	5.61	5.68	5.77	7.23	5.47
Ayrshire	Manton Belle	2	3.67	4.56	5.16	5.60	6.00	6.30	6.36	6.11	13.91	45.57	6.09
Ayrshire	Manton Belle	3	3.74	4.75	5.15	5.47	5.90	6.30	6.68	6.87	8.91	10.80	5.77
Ayrshire	Manton Belle	4	4.74	4.07	4.57	4.54	5.30	5.98	5.70	5.90	6.40	7.30	5.14
Ayrshire	Miss Flow 6th	1	3.50	4.10	4.96	5.26	5.92	6.73	7.30	7.92	8.10	10.44	6.06
Ayrshire	Miss Flow 6th	2	3.30	3.84	5.46	5.46	5.93	6.73	7.63	7.51	8.10	15.44	6.10
Ayrshire	Miss Flow 6th	3	3.85	3.66	4.60	4.90	5.73	6.33	7.52	8.40	9.30	15.44	5.88
Ayrshire	Miss Flow 6th	4	3.33	4.93	4.98	6.43	6.15	6.94	6.94	8.81	13.77	43.23	5.55
Ayrshire	Queen Duchess	1	3.73	4.47	5.38	6.11	5.30	5.34	5.60	5.68	5.93	6.77	5.38
Ayrshire	Queen Duchess	2	1.81	4.31	4.63	4.88	4.94	5.37	5.48	5.68	8.06	15.93	5.67
Devon	Artala	1	4.16	4.30	4.44	4.82	4.98	5.31	6.34	7.73	8.56	10.96	5.71
Devon	Genevieve's Gift	1	5.04	4.70	5.73	6.90	7.30	7.23	7.78	7.70	8.05	6.40	6.48
Devon	Genevieve's Gift	2	5.33	5.64	6.30	6.44	5.87	6.30	6.15	6.17	8.30	36.53	6.64
Devon	Ione	1	4.33	5.64	6.30	5.94	6.30	6.63	7.83	6.34	8.30	8.51	6.55
Devon	Ione	2	3.54	4.34	5.94	6.35	7.43	9.10	9.73	16.60	44.70	.....	7.44
Guernsey	Madame Select	2	4.65	6.14	6.10	6.30	6.35	6.45	6.73	6.07	6.18	6.37	6.09
Guernsey	Oricle	1	3.13	4.31	5.53	6.10	5.55	5.33	5.22	5.15	4.93	5.63	5.13
Guernsey	Oricle	2	4.13	5.33	6.10	6.05	5.34	5.10	5.00	5.30	6.32	5.10	5.41
Guernsey	Rosette Ford	1	4.30	4.83	5.84	6.07	6.30	6.90	6.07	6.04	4.94	6.10	5.40
Guernsey	Rosette Ford	2	4.00	3.91	4.40	4.69	5.38	5.38	10.20	7.30	10.20	10.96	5.80
Guernsey	Stella Select	1	4.10	4.66	5.50	5.41	5.63	6.40	7.70	8.15	8.63	8.63	6.37
Holstein-Friesian	Beauty Pledge	2	3.78	4.01	4.13	4.19	4.44	4.95	5.25	5.67	8.03	10.00	4.78
Holstein-Friesian	Evel 2d	1	4.15	4.81	5.17	5.00	5.34	6.30	5.53	5.87	5.73	7.03	5.55
Holstein-Friesian	Netherland Constance	1	3.24	5.00	5.19	5.00	5.50	5.65	5.37	6.32	6.33	5.94	5.41
Holstein-Friesian	Ruth	1	4.00	5.48	6.01	6.30	6.17	5.96	6.14	7.63	10.00	8.73	6.19

Jersey	1	5.38	6.40	5.99	6.37	6.52	7.57	7.35	6.93	6.35	6.84	6.48
Jersey	2	6.14	5.83	5.61	5.84	6.13	6.30	6.31	6.55	6.96	12.10	6.33
Jersey	1	4.55	6.15	7.15	6.90	6.33	6.53	7.13	7.00	6.41	6.00	6.43
Jersey	2	3.80	4.33	5.50	5.40	6.22	6.56	7.50	8.03	8.53	7.77	6.15
Jersey	3	3.60	4.51	4.60	6.10	5.26	5.31	5.95	6.36	6.25	5.00	6.22
Jersey	1	6.48	5.00	6.83	5.33	6.10	6.30	6.33	7.37	6.53	6.83	6.30
Jersey	2	4.63	4.13	5.07	5.30	5.38	5.53	5.74	6.80	6.75	6.40	6.45
Jersey	3	4.10	5.41	5.93	6.73	6.41	6.33	6.00	6.00	4.80	7.00	5.10
Jersey	4	4.25	4.57	4.64	5.92	5.25	5.95	5.30	5.48	5.23	5.93	5.95
Jersey	1	4.10	5.70	7.05	7.03	7.00	5.73	8.30	7.66	7.34	7.63	6.95
Jersey	3	3.96	3.52	4.65	4.92	5.50	5.24	5.90	6.31	6.63	7.50	5.19
Shorthorn	1	3.21	3.87	3.90	5.17	4.90	6.57	8.86	11.30	9.31	7.90	6.03
Shorthorn	2	2.96	4.39	4.73	5.17	5.29	5.30	5.53	5.28	5.41	4.75	4.90
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Cents												
Highest per pound for last period												7.44
Lowest per pound for last period												4.73
Average for all												5.78

## PER CENT. OF FAT IN MILK DURING EACH MONTH OF LACTATION.

Breed.	NAME OF COW.	Period of lactation.	NUMBER OF MONTH OF LACTATION.										Average per cent. of fat in milk for whole period of lactation.
			First.	Second.	Third.	Fourth.	Fifth.	Sixth.	Seventh.	Eighth.	Ninth.	Tenth.	
American Holderness	Magpie 6th .....	1	3.65	3.26	3.63	3.35	3.15	3.41	3.46	3.65	3.87	3.51	3.41
	Magpie 6th .....	2	3.73	4.04	3.97	3.41	3.25	3.53	3.53	3.99	4.33	3.49	3.73
	Magpie 6th .....	3	4.17	3.85	3.85	3.70	3.68	3.85	4.17	3.57	5.27	3.73	3.73
	Nora .....	1	4.00	3.66	3.56	3.70	3.60	3.40	3.40	3.57	3.60	3.95	3.72
Ayrshire.	Junletta Peerless .....	2	4.37	3.98	3.59	3.55	3.73	3.15	3.38	3.35	4.13	4.39	3.30
	Junletta Peerless .....	3	4.06	3.34	3.93	3.30	3.35	3.33	3.73	3.53	4.05	3.95	3.43
	Manton Belle .....	3	4.00	3.10	3.93	3.43	3.40	3.23	3.35	3.33	4.03	3.75	3.35
	Manton Belle .....	2	4.39	4.00	3.73	3.37	3.93	3.13	3.73	3.15	3.30	3.67	3.67
	Manton Belle .....	3	3.23	3.95	3.87	3.15	3.90	3.53	3.33	3.33	3.47	3.57	3.50
	Manton Belle .....	4	3.37	3.71	3.57	3.15	3.38	3.35	3.13	3.13	3.55	3.57	3.45
	Miss Flow 5th .....	1	5.00	3.95	3.91	4.00	3.80	4.11	4.05	4.37	4.34	4.95	4.34
	Miss Flow 8th .....	2	3.97	3.09	3.93	3.19	3.19	3.47	3.30	3.73	3.77	3.57	3.44
	Miss Flow 8th .....	3	3.97	3.00	3.73	3.46	3.19	3.53	3.68	4.30	4.63	3.57	3.56
	Miss Flow 8th .....	4	3.77	3.75	3.93	3.53	3.70	4.03	4.10	4.15	4.40	4.67	3.88
	Queen Duchess .....	1	4.35	4.48	3.93	3.53	3.73	3.60	3.31	3.93	3.73	3.87	3.97
	Queen Duchess .....	2	3.47	3.92	3.50	3.63	3.45	3.37	3.33	3.71	4.10	4.33	3.66
Devon .....	Artalia .....	1	5.13	4.01	4.59	4.68	4.35	3.87	3.33	3.71	4.10	4.35	
	Genevieve's Gift .....	1	3.35	3.43	3.99	4.53	4.35	4.30	3.65	4.34	4.08	4.33	
	Genevieve's Gift .....	2	4.40	5.01	5.03	5.37	5.10	5.59	5.51	5.33	6.15	4.75	
	Ione .....	1	3.81	4.04	3.68	3.57	3.50	3.37	3.48	5.35	5.40	5.93	
Devon .....	Ione .....	2	4.30	4.33	3.86	4.44	4.66	4.53	4.43	4.44	5.57	4.30	
	Ione .....	2	4.30	4.33	3.86	4.44	4.66	4.53	4.43	4.44	5.57	4.30	
Guernsey .....	Madame Select .....	2	5.50	5.79	6.31	6.47	6.90	6.50	5.92	6.13	5.92	6.13	
	Orlote .....	1	5.87	4.94	4.49	4.36	6.90	6.50	5.92	6.13	5.92	6.13	
	Orlote .....	2	5.87	5.07	5.37	5.60	6.37	4.88	4.93	4.95	6.11	5.39	
	Rosette Ford .....	1	5.40	5.33	4.74	4.90	5.13	5.03	4.81	4.76	4.73	4.97	
	Rosette Ford .....	2	5.33	5.35	4.74	4.90	5.13	5.03	4.81	4.76	4.73	4.97	
	Stella Select .....	1	3.94	4.14	3.95	4.55	3.67	5.97	6.17	6.05	6.13	5.73	
Holstein-Friesian.	Beauty Pledge .....	2	4.38	4.14	3.76	3.70	3.43	4.30	4.81	5.15	5.86	6.31	
	Zeal 2d .....	1	4.86	3.64	3.86	3.64	3.63	3.45	3.30	3.97	4.00	3.77	
	Netherland Constance .....	1	3.70	3.77	3.56	3.97	3.63	3.33	3.55	3.73	3.91	3.95	
	Ruth .....	1	2.93	3.79	3.63	3.90	2.95	3.05	3.00	3.00	3.00	3.93	
	Ruth .....	1	2.93	3.79	3.63	3.90	2.95	3.05	3.00	3.00	3.00	3.93	

Jersey	1	3.99	4.97	4.98	4.64	4.90	5.13	5.78	6.35	6.80	7.05	5.17
Jersey	2	5.17	6.13	5.97	6.07	6.17	6.15	5.75	5.35	5.83	5.17	5.85
Jersey	1	4.93	5.16	5.83	5.15	5.70	5.48	5.39	5.46	5.84	4.90	5.31
Jersey	3	4.65	4.81	4.83	4.48	4.53	4.90	5.13	5.56	6.02	6.06	4.90
Jersey	3	4.15	4.90	5.23	4.90	4.90	6.00	6.45	6.10	6.10	6.40	5.41
Jersey	1	6.11	4.84	5.83	5.36	5.37	6.13	6.00	6.41	6.19	6.45	5.76
Jersey	3	5.69	5.53	5.17	5.95	6.25	6.33	6.05	5.05	4.84	6.48	5.82
Jersey	3	5.90	5.31	5.37	6.25	6.05	6.30	6.34	6.05	6.05	5.45	6.09
Jersey	4	5.37	6.01	6.31	6.10	6.35	6.00	6.72	6.47	5.77	5.65	6.09
Jersey	1	6.10	5.63	5.19	6.16	5.47	5.37	5.68	5.61	5.63	5.65	5.65
Jersey	3	5.55	4.56	5.33	5.33	5.75	5.30	5.45	5.35	5.70	6.28	5.45
Shorthorn	1	4.56	4.03	3.93	3.88	3.95	4.15	4.45	4.43	5.03	4.80	4.33
Shorthorn	2	4.49	4.03	4.13	4.03	4.73	4.75	4.45	4.50	4.53	4.37	4.56
		208.97	193.96	196.53	202.14	201.47	203.85	209.61	214.16	215.51	234.93	306.35
		4.54	4.33	4.33	4.39	4.38	4.53	4.56	4.65	4.79	5.00	4.48

## POUNDS OF FAT IN MILK PRODUCED DURING EACH MONTH OF LACTATION.

Breed.	NAME OF COW.	Period of lactation.	NUMBER OF MONTHS OF LACTATION.										Pounds of fat in milk for whole period of lactation.
			First.	Second.	Third.	Fourth.	Fifth.	Sixth.	Seventh.	Eighth.	Ninth.	Tenth.	
American Holderness	Maggie 6th.....	1	30.22	19.67	18.96	16.57	13.13	15.32	14.43	15.54	15.77	13.80	164.1
American Holderness	Maggie 6th.....	2	16.06	36.40	30.55	26.19	19.34	21.74	20.23	21.45	19.55	14.22	267.4
American Holderness	Maggie 6th.....	3	30.03	32.03	28.37	28.68	23.86	30.20	26.40	24.39	14.07	1.13	281.4
American Holderness	Nora.....	1	24.84	29.77	25.26	23.68	23.86	23.14	17.81	18.55	19.39	18.06	229.5
Ayrshire.....	Junetta Pearlless.....	2	36.41	28.57	25.02	22.14	21.56	26.50	25.09	22.64	19.16	7.33	233.4
Ayrshire.....	Junetta Pearlless.....	3	39.84	24.21	30.59	29.56	27.33	30.31	32.54	31.01	30.39	18.51	304.4
Ayrshire.....	Manion Belle.....	1	31.33	20.14	18.49	24.45	23.42	21.30	21.91	21.23	20.13	17.43	210.3
Ayrshire.....	Manion Belle.....	2	37.77	24.59	31.37	31.06	26.36	23.22	19.10	14.86	8.30	2.35	233.0
Ayrshire.....	Manion Belle.....	3	43.66	46.22	33.22	33.99	33.16	21.16	23.55	21.16	18.12	13.28	262.5
Ayrshire.....	Manion Belle.....	4	30.46	31.23	33.77	33.36	27.59	27.89	25.69	21.68	19.06	15.35	246.7
Ayrshire.....	Miss Flow 5th.....	2	34.77	24.79	22.43	23.52	22.46	21.96	22.34	19.64	18.73	16.33	217.8
Ayrshire.....	Miss Flow 5th.....	3	2.49	17.57	18.29	19.11	18.06	18.50	17.61	17.01	15.46	12.87	176.0
Ayrshire.....	Miss Flow 5th.....	4	23.13	27.16	25.51	27.43	23.18	25.81	23.81	17.84	17.77	3.00	231.4
Ayrshire.....	Miss Flow 5th.....	5	34.82	30.56	3.80	25.54	26.54	27.41	23.39	20.36	12.77	3.00	236.3
Ayrshire.....	Queen Duchess.....	1	35.05	30.07	27.57	25.98	23.61	26.50	21.48	27.10	24.64	25.35	270.8
Ayrshire.....	Queen Duchess.....	2	30.77	35.94	30.34	31.59	29.47	31.13	25.05	26.07	17.14	7.05	266.7
Devon.....	Artilla.....	1	30.12	23.72	26.61	25.81	31.03	23.32	13.38	16.94	13.93	13.19	217.1
Devon.....	Genevieve's Gift.....	1	10.60	13.51	15.39	15.37	13.12	15.51	13.40	15.91	16.93	15.48	145.0
Devon.....	Genevieve's Gift.....	2	26.02	27.54	26.00	24.53	23.43	23.74	23.96	19.07	13.86	8.57	209.7
Devon.....	Ione.....	1	15.49	17.49	18.62	18.83	18.05	17.78	15.96	16.36	17.37	15.32	169.8
Devon.....	Ione.....	2	2.00	22.02	21.76	23.86	21.42	20.05	16.16	8.07	.....	.....	175.0
Guernsey.....	Madame Select.....	2	31.03	35.05	34.81	33.30	29.74	30.84	26.31	28.39	23.31	23.18	232.4
Guernsey.....	Orlolo.....	1	29.06	21.74	23.91	27.34	27.25	28.08	27.07	28.67	26.14	25.14	261.4
Guernsey.....	Orlolo.....	2	29.71	27.70	31.84	27.03	29.50	27.96	29.12	29.59	28.38	23.90	236.1
Guernsey.....	Rosette Ford.....	1	31.06	29.91	26.62	31.63	26.70	24.04	24.81	22.66	21.93	22.51	241.9
Guernsey.....	Rosette Ford.....	2	27.17	26.56	43.40	45.07	20.38	20.38	26.33	18.93	18.09	18.09	240.4
Guernsey.....	Stella Select.....	1	29.27	26.35	23.79	27.79	22.61	22.62	19.73	21.77	22.45	24.90	140.7
Holstein-Friesian.....	Beauty Pledge.....	2	33.06	49.57	45.88	50.49	35.94	34.39	23.86	30.30	17.05	9.07	232.8
Holstein-Friesian.....	Zeel 2d.....	1	31.64	32.19	31.55	33.41	27.47	23.46	28.05	24.46	24.96	21.59	231.7
Holstein-Friesian.....	Netherland Constance.....	1	19.76	30.30	29.90	31.50	30.61	23.79	27.20	23.67	23.67	24.00	277.1
Holstein-Friesian.....	Ruth.....	1	24.74	26.57	21.23	24.68	20.34	19.31	15.61	12.57	10.51	7.36	186.7

Jersey	Albert's Carol	1	94.08	95.30	98.71	91.79	19.05	98.49	94.98	97.90	97.04	98.40	944.9
Jersey	Albert's Carol	2	91.83	93.08	93.75	90.70	91.99	98.79	97.50	19.77	18.87	9.55	946.4
Jersey	Barbara Allen	1	96.53	95.69	96.34	96.09	93.99	99.46	98.57	92.59	93.81	93.96	946.8
Jersey	Barbara Allen	2	96.04	95.74	97.41	96.39	94.81	93.97	94.65	94.90	93.87	93.76	946.8
Jersey	Barbara Allen	3	96.96	96.91	40.94	93.71	90.93	97.47	98.91	98.84	93.00	93.01	947.9
Jersey	Countess Flavia	1	95.70	90.85	84.15	91.11	90.82	90.15	98.44	98.58	97.78	99.01	954.4
Jersey	Countess Flavia	2	95.08	99.79	93.67	90.14	91.60	91.04	90.65	98.99	91.08	92.49	958.9
Jersey	Countess Flavia	3	90.89	97.31	99.82	90.82	91.14	90.77	90.39	98.90	93.08	18.55	968.4
Jersey	Countess Flavia	4	90.61	43.98	44.10	95.16	43.35	95.71	98.47	98.05	93.83	91.54	947.9
Jersey	Gilderbloom	1	99.64	90.10	94.59	95.80	93.43	18.44	19.43	17.53	30.08	17.83	956.1
Jersey	Gilderbloom	2	81.46	92.02	93.98	93.79	95.08	93.43	90.37	97.81	98.33	93.98	967.8
Shorthorn	Betsy 10th.	1	98.55	97.62	95.50	90.63	16.81	18.00	19.48	19.68	90.67	17.73	914.7
Shorthorn	Betsy 10th.	2	99.81	41.49	95.89	95.19	93.71	90.98	95.00	98.91	97.15	93.63	953.3

## POUNDS OF BUTTER (CONTAINING 85 PER CENT. BUTTER FAT) PRODUCED DURING EACH MONTH OF LACTATION.

Breed.	NAME OF COW.	Period of lactation.	NUMBER OF MONTH OF LACTATION.										Pounds of butter produced during whole period of lactation.
			First.	Second.	Third.	Fourth.	Fifth.	Sixth.	Seventh.	Eighth.	Ninth.	Tenth.	
American Holderness	Maggie 6th	1	32.54	23.02	31.34	18.55	14.06	17.17	16.19	17.47	17.78	15.46	184.3
	Maggie 6th	2	18.73	41.38	34.19	29.37	22.03	34.43	32.73	32.73	33.15	16.19	265.0
	Maggie 6th	3	32.70	36.10	31.75	31.07	31.49	30.30	30.87	30.87	31.70	1.30	261.0
	Nora	1	38.30	38.50	38.36	38.00	26.82	36.06	19.36	20.84	31.70	30.40	258.4
Ayrshire.	Junetta Peerless.	2	41.31	31.82	27.63	34.40	23.16	33.49	33.12	25.35	31.65	8.30	261.0
	Junetta Peerless.	3	45.03	35.24	34.37	33.05	30.32	33.78	35.64	34.10	34.34	20.93	341.8
	Manton Belle	1	23.47	30.51	27.41	26.35	34.39	34.54	23.74	22.60	19.03	235.7	
	Manton Belle	2	43.70	35.33	33.14	32.06	35.02	31.13	16.10	9.28	2.64	300.6	
	Manton Belle	3	48.91	53.18	35.32	37.09	37.41	31.53	36.35	23.43	14.33	338.3	
	Manton Belle	4	34.40	35.26	37.63	37.35	30.30	31.18	32.37	24.43	17.35	359.0	
	Miss Flow 5th	1	33.31	37.99	35.30	36.56	35.34	32.81	25.35	22.35	31.32	18.33	346.0
	Miss Flow 5th	2	34.26	20.05	30.34	31.34	30.17	30.75	19.16	17.42	13.90	197.4	
	Miss Flow 5th	3	36.35	30.23	29.37	30.77	34.05	33.29	34.93	24.03	30.19	10.33	350.3
	Miss Flow 5th	4	35.68	34.40	35.31	32.80	32.97	30.96	32.43	23.00	14.50	3.40	305.5
	Queen Duchess	1	39.72	34.09	31.14	29.33	30.24	34.03	30.56	37.75	36.52	9.00	500.6
	Queen Duchess	2	34.51	40.55	33.96	35.51	33.06	36.00	35.73	29.51	19.57	9.00	500.6
Devon.	Artalla	1	34.34	26.80	30.30	29.31	27.33	30.38	31.51	19.18	15.75	14.33	146.0
	Genevieve's Gift	1	11.87	15.40	17.35	17.35	14.94	17.73	15.31	19.18	19.46	17.73	164.7
	Genevieve's Gift	2	39.51	31.28	29.72	26.73	30.63	37.09	37.37	31.75	15.81	4.10	238.8
	Genevieve's Gift	3	17.45	19.75	21.02	20.69	30.17	18.15	17.41	19.84	17.40	192.4	
Devon.	Genevieve's Gift	2	34.95	35.32	34.53	27.04	34.33	32.51	19.34	9.34	.....	.....	300.0
	Genevieve's Gift	2	35.44	38.51	39.92	37.06	33.35	35.39	30.01	33.51	33.57	36.30	335.0
Guernsey	Orion	1	34.43	34.74	34.66	26.50	31.01	31.94	30.90	33.19	33.66	36.70	337.5
	Orion	2	33.99	43.40	42.80	38.60	43.44	34.37	33.94	33.38	33.00	373.2	
	Rosette Ford	1	34.02	30.36	30.36	36.39	29.33	37.38	36.33	32.76	34.94	33.63	373.2
	Rosette Ford	2	43.40	64.62	63.16	46.10	34.74	33.88	31.76	30.70	40.05	373.0	
Guernsey	Stella Select	1	33.05	39.79	38.56	31.53	35.44	35.63	31.75	34.81	35.67	36.55	373.0
	Stella Select	2	35.85	56.00	51.03	56.09	43.06	36.47	29.37	32.81	19.36	10.37	363.5
Holstein-Friesian	Beauty Pledge.	2	35.85	56.00	51.03	56.09	43.06	36.47	29.37	32.81	19.36	10.37	363.5
	Beal 3d.	1	35.00	36.17	31.94	30.91	37.06	31.53	37.54	23.16	34.39	317.7	
	Ketherland Constance	1	31.88	33.47	33.96	34.13	34.13	37.46	30.36	29.51	26.26	36.06	308.3
	Ruth	1	37.45	39.13	37.36	33.04	31.53	17.35	14.00	11.70	8.35	6.35	303.8

Jersey .....	1	27.18	28.73	26.83	24.75	22.64	25.65	28.57	31.65	32.07	30.36	276.5
Jersey .....	2	24.88	27.73	26.64	25.16	28.07	23.00	31.46	22.55	21.05	10.90	280.0
Jersey .....	1	23.06	29.51	29.06	28.57	23.29	26.66	24.91	26.07	25.09	26.12	280.0
Jersey .....	2	23.58	27.35	31.04	28.20	28.30	26.26	26.11	27.65	25.84	27.29	280.3
Jersey .....	3	24.33	44.30	45.90	27.94	40.66	42.91	43.34	41.06	37.81	29.84	286.5
Jersey .....	1	23.45	34.07	37.30	24.49	36.19	34.92	32.17	32.55	31.58	33.28	327.0
Jersey .....	2	26.33	45.47	44.33	24.51	36.19	35.60	35.11	26.11	24.06	25.81	324.1
Jersey .....	3	24.73	42.63	40.96	24.51	36.19	35.28	34.78	27.43	26.29	15.47	327.0
Jersey .....	4	25.00	50.37	50.57	24.72	49.70	40.90	44.18	29.12	27.25	24.63	326.7
Jersey .....	1	33.97	34.41	28.05	28.99	26.75	21.04	22.20	19.69	22.97	20.38	326.4
Jersey .....	3	35.96	37.39	36.72	27.88	40.06	37.00	33.41	31.84	32.59	27.48	351.2
Shorthorn .....	1	22.43	31.30	28.77	23.27	18.98	20.35	22.10	22.31	23.55	20.17	243.3
Shorthorn .....	2	45.16	49.41	40.40	43.40	27.14	25.23	29.51	30.55	30.78	25.69	267.0

## POUNDS OF BUTTER (CONTAINING 85 PER CENT. OF FAT) MADE FROM 100 POUNDS OF MILK.

Breed.	NAME OF COW.	Period of lactation.	NUMBER OF MONTHS OF LACTATION.										Average amount of butter made from 100 pounds of milk for whole period of lactation.
			First.	Second.	Third.	Fourth.	Fifth.	Sixth.	Seventh.	Eighth.	Ninth.	Tenth.	
American Holderness .....	Maggie 8th .....	1	4.14	3.76	4.06	3.76	3.55	3.53	3.88	4.06	4.36	3.71	3.98
American Holderness .....	Maggie 6th .....	2	4.19	4.56	3.66	3.82	3.64	4.03	4.02	4.60	4.96	5.75	4.19
American Holderness .....	Maggie 6th .....	3	4.73	4.34	3.75	4.40	4.07	4.34	4.72	4.70	6.01	6.93	4.43
American Holderness .....	Nora .....	1	5.23	4.14	4.00	4.16	4.06	4.16	3.81	4.01	4.06	4.46	4.19
Ayrshire .....	Junietta Peerless .....	3	4.83	3.39	3.96	3.81	3.03	3.53	3.79	3.75	4.06	4.90	3.53
Ayrshire .....	Junietta Peerless .....	2	4.63	3.63	3.36	3.65	3.16	3.61	4.19	3.95	4.53	4.46	3.85
Ayrshire .....	Manton Belle .....	1	4.83	3.46	3.13	3.64	3.81	3.67	3.76	3.61	3.84	4.23	3.76
Ayrshire .....	Manton Belle .....	2	4.86	4.53	4.19	4.75	4.43	3.46	3.73	3.55	3.53	4.00	4.13
Ayrshire .....	Manton Belle .....	3	3.73	4.46	4.36	4.01	4.40	4.02	3.73	3.96	3.89	4.01	4.00
Ayrshire .....	Manton Belle .....	4	4.36	4.18	4.01	3.53	3.60	3.75	3.98	3.48	3.99	4.01	3.87
Ayrshire .....	Miss Flow 5th .....	1	6.40	4.47	4.41	4.58	4.28	4.54	4.58	4.96	4.93	5.64	4.80
Ayrshire .....	Miss Flow 5th .....	2	4.48	3.45	3.26	3.53	3.56	3.89	4.40	4.30	4.35	4.01	3.86
Ayrshire .....	Miss Flow 5th .....	3	4.46	3.34	3.06	3.58	3.56	3.95	4.38	4.75	5.36	6.10	4.00
Ayrshire .....	Miss Flow 5th .....	4	4.25	4.23	4.42	3.95	4.16	4.61	4.63	4.60	4.99	5.31	4.38
Ayrshire .....	Queen Duches .....	1	4.93	5.08	4.44	4.44	4.26	4.05	3.71	4.35	4.19	4.13	4.37
Ayrshire .....	Queen Duches .....	2	3.80	4.43	3.33	4.07	3.87	4.36	3.73	4.18	4.63	4.51	4.13
Devon .....	Artalia .....	1	5.85	4.53	5.13	5.30	4.96	4.75	4.14	4.80	4.61	4.80	4.90
Devon .....	Genevieve's Gift .....	1	3.64	3.84	4.50	5.32	5.64	6.38	6.30	6.07	7.05	6.94	5.40
Devon .....	Genevieve's Gift .....	2	4.99	5.71	6.19	6.36	5.81	6.13	6.26	6.10	6.16	7.81	5.96
Devon .....	Lone .....	1	4.56	4.54	4.44	4.35	4.42	5.14	5.61	5.03	6.36	5.59	5.10
Devon .....	Lone .....	2	4.75	4.84	4.35	5.03	5.39	5.56	6.14	6.81	5.96	.....	5.17
Guernsey .....	Madame Select .....	2	6.28	6.63	7.31	7.42	7.92	7.46	6.79	7.03	6.89	6.78	7.03
Guernsey .....	Orlo .....	2	7.59	5.09	6.13	6.44	5.56	5.49	5.52	5.64	5.83	6.04	5.73
Guernsey .....	Orlo .....	2	6.48	5.78	6.13	6.40	6.13	6.73	6.11	5.89	5.99	6.32	6.19
Guernsey .....	Rosette Ford .....	1	6.16	6.07	5.39	5.55	5.85	5.84	5.73	5.41	5.88	5.87	5.66
Guernsey .....	Rosette Ford .....	2	6.07	6.34	6.01	6.36	6.84	6.52	7.07	7.64	7.14	7.16	6.95
Guernsey .....	Stella Select .....	1	4.46	4.63	4.46	5.16	4.13	4.87	5.47	5.87	6.70	7.34	5.13
Holstein-Friesian .....	Beauty Pledge .....	1	4.86	4.86	4.33	4.16	3.84	3.87	3.83	4.48	4.52	6.01	4.36
Holstein-Friesian .....	Ezel xl .....	1	5.53	4.09	4.35	4.09	4.13	4.49	3.99	4.30	4.41	4.46	4.34
Holstein-Friesian .....	Netherland Constance .....	1	2.99	3.07	2.93	3.31	3.60	3.75	3.19	3.34	3.51	3.33	3.36
Holstein-Friesian .....	Ruth .....	1	3.13	3.09	3.96	3.32	3.38	3.40	3.33	3.25	3.33	3.61	3.30

Jersey .....	1	4.50	5.19	4.84	5.27	5.23	5.85	6.61	7.38	7.46	8.11	5.89
Jersey .....	2	5.50	7.01	6.84	6.95	7.07	7.05	6.53	6.10	6.65	6.69	6.70
Jersey .....	1	5.80	5.86	6.06	6.24	6.53	6.36	6.15	6.53	6.09	5.53	6.04
Jersey .....	2	5.38	5.47	4.79	5.06	5.30	5.45	5.85	6.35	6.20	5.53	5.66
Jersey .....	3	4.69	5.98	6.02	5.58	5.53	6.57	7.40	6.09	6.99	7.34	6.18
Jersey .....	1	7.00	5.51	6.07	6.81	6.16	7.01	6.87	7.35	7.09	7.40	6.58
Jersey .....	2	6.51	6.81	7.07	6.81	7.16	7.35	6.93	5.75	5.51	7.38	6.66
Jersey .....	3	6.76	6.7	7.31	7.16	6.93	7.11	7.25	6.93	6.96	6.84	6.98
Jersey .....	4	6.12	6.88	7.34	6.90	7.16	6.87	7.72	7.42	6.60	6.46	6.98
Jersey .....	1	6.99	6.48	5.92	7.06	6.24	6.13	6.49	6.41	6.44	6.46	6.46
Jersey .....	2	6.34	5.18	6.14	5.93	6.56	6.06	6.23	6.81	6.53	7.32	6.12
Shorthorn .....	1	5.18	4.54	4.4	4.38	4.46	4.69	5.05	5.01	5.72	5.46	4.65
Shorthorn .....	2	5.09	5.25	5.16	5.25	5.36	5.4	5.05	5.11	5.16	4.83	5.18

## POUNDS OF MILK REQUIRED TO MAKE ONE POUND OF BUTTER DURING EACH MONTH OF LACTATION.

Breed.	NAME OF COW.	Period of lactation.	NUMBER OF MONTHS OF LACTATION.										Average for whole period of lactation.
			First.	Second.	Third.	Fourth.	Fifth.	Sixth.	Seventh.	Eighth.	Ninth.	Tenth.	
American Holderness	Maggie 6th	1	94.15	26.00	24.51	26.09	26.17	26.18	25.77	24.51	22.94	22.95	25.60
American Holderness	Maggie 6th	2	27.87	21.93	27.37	26.18	27.37	24.87	24.87	24.87	20.16	17.86	23.87
American Holderness	Maggie 6th	3	21.18	26.07	26.73	24.78	24.97	21.05	21.18	21.05	16.64	14.43	22.63
American Holderness	Nora	1	19.16	24.15	25.00	24.05	24.69	24.05	20.24	24.98	24.09	22.48	22.87
Ayrshire	Junietta Peerless	2	20.70	30.12	34.97	35.59	33.11	28.41	26.88	26.67	21.46	20.45	28.00
Ayrshire	Junietta Peerless	3	21.74	27.63	30.77	27.95	31.65	27.70	23.87	25.34	21.83	22.48	26.00
Ayrshire	Manton Belle	1	22.12	28.90	31.95	27.04	26.24	27.25	26.60	27.70	26.04	22.70	26.00
Ayrshire	Manton Belle	2	20.58	28.12	28.87	21.04	22.63	28.74	33.11	26.17	27.93	25.00	24.21
Ayrshire	Manton Belle	3	20.88	22.43	23.94	24.93	22.73	24.87	26.88	27.78	25.71	24.93	25.00
Ayrshire	Manton Belle	4	24.94	23.93	24.93	23.41	27.78	26.67	25.06	26.74	25.16	24.93	26.94
Ayrshire	Miss Flow 5th	1	15.63	22.39	22.69	22.11	22.88	21.55	21.83	20.20	20.24	17.73	20.83
Ayrshire	Miss Flow 5th	2	22.32	26.99	30.67	28.38	26.09	26.71	22.73	23.89	23.53	24.93	26.21
Ayrshire	Miss Flow 5th	3	23.82	20.94	32.47	25.32	21.05	21.69	22.83	21.05	10.04	16.83	23.83
Ayrshire	Miss Flow 5th	4	21.53	23.70	22.63	25.32	21.05	21.69	21.69	21.69	23.87	24.21	22.91
Ayrshire	Queen Duchess	1	20.28	19.68	22.63	22.42	23.46	24.09	26.95	25.00	23.87	24.21	22.91
Ayrshire	Queen Duchess	2	25.71	22.62	26.41	24.57	25.54	22.94	26.83	23.92	21.60	20.79	24.27
Devon	Artalia	1	17.09	22.07	19.49	19.23	20.16	21.05	24.15	20.83	21.69	20.83	20.41
Devon	Genevieve's Gift	2	27.47	26.04	22.17	18.79	15.69	15.69	15.90	16.47	14.18	14.41	18.59
Devon	Genevieve's Gift	3	20.04	17.51	16.41	15.78	17.31	16.31	15.97	16.39	16.23	12.80	16.78
Devon	Lone	1	23.09	21.43	22.63	22.63	22.63	19.45	17.78	19.86	15.73	18.90	20.53
Devon	Lone	2	21.05	20.66	23.00	19.36	18.90	17.99	16.49	14.68	.....	.....	19.60
Guernsey	Madame Select	2	15.92	15.10	13.21	13.47	12.65	14.40	14.76	14.25	14.52	14.75	14.25
Guernsey	Orlo	1	12.67	17.79	19.65	20.84	17.90	18.32	18.12	17.74	17.18	16.56	17.46
Guernsey	Orlo	2	15.48	17.30	16.81	15.63	16.31	14.93	16.37	16.98	16.69	16.09	16.16
Guernsey	Rosette Ford	1	16.23	16.47	18.45	17.92	17.13	17.48	18.26	18.48	18.69	17.64	18.97
Guernsey	Rosette Ford	2	16.47	15.77	16.64	14.63	15.44	14.14	13.09	14.00	13.87	15.37	15.87
Guernsey	Stella Select	1	22.47	21.87	22.42	19.38	24.21	20.53	18.26	17.04	14.92	13.81	19.53
Holstein-Friesian	Beauty Pledge	2	20.68	21.37	23.64	24.06	26.84	25.84	27.98	22.82	23.13	16.61	26.83
Holstein-Friesian	Esel 3d	1	18.06	24.45	21.00	20.45	24.57	23.63	25.06	23.60	23.69	22.48	25.04
Holstein-Friesian	Netherland Constance	1	33.44	33.57	33.46	30.21	27.78	26.67	31.85	29.94	29.94	31.06	30.67
Holstein-Friesian	Esel	1	31.96	33.86	33.78	31.08	30.49	29.41	31.06	30.77	30.49	27.47	31.25

Jersey	1	22.17	19.37	20.08	18.98	19.16	17.09	15.13	13.75	13.40	12.33	17.00
Jersey	2	16.98	14.37	14.68	14.39	14.14	14.18	15.19	16.39	15.01	16.98	14.90
Jersey	3	17.86	17.01	16.45	15.77	15.31	15.97	16.27	16.06	16.48	17.93	16.50
Jersey	4	18.94	18.18	20.88	19.68	19.33	18.31	17.09	15.75	14.98	18.07	17.70
Jersey	5	21.32	17.94	16.61	17.93	17.94	14.56	13.51	14.31	14.31	13.02	16.18
Jersey	6	14.39	18.16	16.47	6.37	16.31	14.37	14.66	13.60	14.10	13.51	15.21
Jersey	7	15.36	15.85	14.14	14.68	13.97	13.79	14.43	17.80	18.15	13.54	15.00
Jersey	8	14.79	14.77	18.68	13.97	14.43	14.08	13.79	14.43	14.37	16.08	14.33
Jersey	9	16.34	14.54	13.81	14.31	13.57	14.56	12.95	13.47	15.15	15.48	14.33
Jersey	10	14.31	15.68	16.89	14.16	16.03	16.31	15.41	15.40	15.53	15.50	15.59
Jersey	11	15.77	19.20	16.39	16.81	15.80	16.53	16.08	14.68	15.34	13.66	16.08
Rhorthorn	1	19.30	22.03	22.03	22.83	22.43	21.32	19.80	19.98	17.48	18.31	20.62
Rhorthorn	2	19.65	19.05	19.49	19.05	18.66	18.53	19.50	19.57	19.38	30.70	19.20

### **COST OF ONE POUND OF MILK-FAT DURING EACH MONTH OF LACTATION.**

Breed.	NAME OF COW.	Period of lactation.	NUMBER OF MONTHS OF LACTATION.										Average cost of one pound of milk-fat for whole period of lactation.
			First.	Second.	Third.	Fourth.	Fifth.	Sixth.	Seventh.	Eighth.	Ninth.	Tenth.	
American Holderness	Maggie 6th.....	1	17.70	24.10	22.53	23.84	26.76	25.65	24.58	23.21	26.30	23.70	23.70
	Maggie 6th.....	2	16.15	18.17	14.66	22.50	24.16	27.99	24.50	23.82	29.82	30.75	20.82
	Maggie 6th.....	3	12.83	13.13	18.58	19.35	19.26	19.70	18.40	23.00	36.18	300.14	20.61
	Nora.....	1	10.07	14.00	16.40	17.31	17.70	17.68	20.33	22.70	26.00	16.30	16.46
	Ayrshire.....	3	9.94	18.00	20.00	23.90	23.40	14.15	24.08	25.50	24.37	55.00	31.90
Ayrshire.....	Junetta Peerless.....	1	8.43	13.05	16.60	30.64	30.87	18.64	17.40	19.75	18.00	27.31	17.31
	Junetta Peerless.....	2	13.33	16.73	23.10	30.50	30.71	21.10	19.73	20.37	31.08	26.00	30.10
	Manton Belle.....	3	13.33	16.73	23.10	30.50	30.71	21.10	19.73	20.37	31.08	26.00	30.10
	Manton Belle.....	4	15.50	14.72	16.40	18.94	18.40	22.91	22.40	23.64	27.00	217.40	31.94
	Manton Belle.....	1	15.50	14.72	16.40	18.94	18.40	22.91	22.40	23.64	27.00	217.40	30.00
	Manton Belle.....	2	10.08	12.47	15.04	15.94	19.40	18.70	19.34	22.70	22.15	26.50	18.03
	Manton Belle.....	3	9.98	12.47	15.04	15.94	19.40	18.70	19.34	22.70	22.15	26.50	18.03
	Miss Flow 5th.....	4	10.63	16.50	22.00	23.90	21.11	21.50	23.63	23.68	22.13	21.40	22.93
	Miss Flow 5th.....	2	10.63	16.50	22.00	23.90	21.11	21.50	23.63	23.68	22.13	21.40	22.93
	Miss Flow 5th.....	3	9.74	16.51	19.04	23.83	22.69	24.55	23.03	23.07	23.70	43.00	21.73
Ayrshire.....	Miss Flow 5th.....	4	11.28	16.13	19.04	23.83	22.69	24.55	23.03	23.07	23.70	43.00	21.73
	Queen Duchess.....	1	11.63	13.37	17.15	20.00	19.90	20.50	21.11	22.53	20.80	18.10	31.84
	Queen Duchess.....	2	11.63	13.37	17.15	20.00	19.90	20.50	21.11	22.53	20.80	18.10	31.84
	Queen Duchess.....	3	6.89	14.03	17.06	16.16	16.40	18.30	21.46	19.75	26.00	56.10	18.44
Devon.....	Artalia.....	1	12.33	14.93	14.20	15.37	16.44	19.25	25.00	23.15	33.43	38.00	19.35
	Genevieve's Gift.....	1	19.34	17.40	12.48	18.86	21.04	20.31	23.58	20.70	19.34	18.90	19.50
	Genevieve's Gift.....	2	16.00	17.03	15.43	17.00	17.74	16.50	16.62	17.35	23.30	30.00	18.48
	Ione.....	1	15.43	18.63	21.00	20.52	21.65	21.13	20.53	24.53	32.00	21.40	21.40
	Ione.....	2	11.81	13.98	20.73	22.63	22.68	27.73	35.00	44.60	.....	24.00	24.00
Guernsey.....	Madame Select.....	2	13.33	17.32	16.80	16.00	16.00	16.54	18.00	15.95	15.47	17.03	16.31
	Orville.....	1	7.34	12.05	16.26	19.31	15.90	15.93	15.40	14.82	14.37	16.07	14.61
	Orville.....	2	10.80	15.10	16.84	16.36	14.73	13.18	13.69	14.60	17.34	14.73	14.73
	Rosette Ford.....	1	13.40	13.36	17.36	20.00	18.00	20.17	18.26	18.44	14.60	16.40	16.40
	Rosette Ford.....	2	10.70	10.15	12.13	12.90	14.33	17.51	19.00	22.80	39.70	15.70	15.70
Guernsey.....	Stella Select.....	1	14.00	15.87	18.40	16.30	20.57	20.87	23.32	24.60	24.10	23.37	19.70
	Beauty Pledge.....	2	11.66	13.33	12.64	13.29	15.00	16.19	18.31	18.30	26.44	30.14	15.35
	Real M.....	1	11.60	16.93	16.40	20.53	18.43	20.44	20.43	20.93	30.40	35.46	18.79

Holstein-Friesian.....	1	26.83	19.70	31.84	18.76	19.14	19.45	21.33	19.89	22.80	20.50	20.75
Holstein-Friesian.....	1	15.73	20.90	28.91	23.72	22.80	21.54	23.77	20.55	29.88	31.66	23.63
Netherland Constance.....												
Ruth .....	1											
Albert's Carol .....	1	17.48	19.92	18.22	19.04	20.75	22.22	21.86	18.37	16.53	16.60	18.96
Albert's Carol .....	2	14.57	13.57	14.96	15.00	15.56	16.15	17.00	19.27	19.28	26.86	16.63
Barbara Allen .....	1	12.96	17.22	19.13	18.96	17.00	19.14	20.80	19.06	18.66	18.21	18.00
Barbara Allen .....	2	12.37	18.22	18.06	17.10	19.40	20.12	22.40	21.86	24.70	20.00	16.77
Barbara Allen .....	3	11.43	19.83	19.69	17.00	15.86	13.64	14.53	16.63	16.50	14.61	14.76
Barbara Allen .....	4	11.43	19.83	19.69	17.00	15.86	13.64	14.53	16.63	16.50	14.61	14.76
Countess Flavia .....	1	15.90	14.78	19.14	14.88	16.84	16.86	16.77	19.10	18.17	18.00	17.00
Countess Flavia .....	2	13.03	12.00	13.60	14.80	14.70	14.86	16.66	21.07	22.22	17.07	15.44
Countess Flavia .....	3	11.19	14.97	14.40	17.80	17.06	16.44	15.80	16.43	12.50	22.80	15.38
Countess Flavia .....	4	11.86	11.69	11.97	12.95	13.33	13.66	12.74	13.90	14.27	16.25	12.96
Gliderbloom .....	1	10.19	15.00	13.70	17.74	19.76	24.14	21.00	21.12	19.00	20.86	18.44
Gliderbloom .....	2	7.92	11.67	12.66	13.78	14.16	14.43	16.90	16.22	17.78	17.33	14.07
Betsy 10th .....	1	10.43	14.23	13.37	17.81	17.00	22.72	20.88	31.80	22.20	20.10	20.50
Betsy 10th .....	2	9.10	13.22	14.80	16.16	16.80	16.17	18.00	16.65	16.96	15.96	15.00
Shorthorn .....												
Shorthorn .....												

## COST OF ONE POUND OF BUTTER DURING EACH MONTH OF LACTATION.

Breed.	NAME OF COW.	Period of lactation.	NUMBER OF MONTH OF LACTATION.										Average cost of one pound of butter for whole lactation.
			First.	Second.	Third.	Fourth.	Fifth.	Sixth.	Seventh.	Eighth.	Ninth.	Tenth.	
			Cents.	Cents.	Cents.	Cents.	Cents.	Cents.	Cents.	Cents.	Cents.	Cents.	Cents.
American Holderness	Maggie 6th	1	16.72	21.53	10.05	21.30	21.15	22.90	22.50	21.56	20.60	21.12	21.12
American Holderness	Maggie 6th	2	14.36	11.66	13.10	16.36	30.10	21.50	34.62	23.84	23.57	26.19	18.44
American Holderness	Maggie 6th	3	11.32	11.32	14.60	16.30	17.0	16.24	16.24	30.32	31.72	19.50	19.50
American Holderness	Nora	1	8.87	12.45	14.60	15.40	15.66	17.10	18.15	15.74	17.74	14.36	14.08
Ayrshire	Junietta Peerless	1	8.78	16.15	18.10	21.64	21.12	21.02	21.50	23.04	21.0	49.40	19.50
Ayrshire	Junietta Peerless	2	7.46	11.70	14.92	18.45	18.60	16.67	15.45	17.60	15.93	23.30	16.33
Ayrshire	Manton Belle	1	11.70	16.6	20.83	18.38	18.48	18.86	17.60	18.66	18.76	12.87	17.95
Ayrshire	Manton Belle	2	10.58	13.17	14.58	15.68	7.70	20.56	26.56	23.10	10.90	185.60	19.63
Ayrshire	Manton Belle	3	13.62	13.62	14.81	16.90	11.81	14.40	21.60	21.29	27.85	31.55	17.80
Ayrshire	Manton Belle	4	14.19	11.97	13.40	15.17	17.16	16.74	17.18	17.63	19.11	22.43	16.00
Ayrshire	Miss Flow 6th	1	8.12	14.90	18.61	21.16	27.60	19.07	20.90	20.90	22.53	27.70	19.70
Ayrshire	Miss Flow 6th	2	9.44	16.45	20.66	18.96	30.77	19.90	20.40	24.90	26.70	36.10	20.48
Ayrshire	Miss Flow 6th	3	8.64	14.65	17.73	17.16	20.40	21.58	23.08	25.62	26.30	37.70	19.83
Ayrshire	Miss Flow 5th	1	10.00	14.33	14.12	20.33	18.70	18.13	20.28	25.62	35.98	118.34	19.86
Ayrshire	Queen Duchess	1	10.32	11.70	17.76	17.76	16.70	17.76	30.07	17.10	18.60	18.44	16.04
Ayrshire	Queen Duchess	2	5.15	13.43	15.30	14.47	16.30	16.34	19.30	19.34	34.73	49.66	16.40
Devon	Artala	1	10.77	13.18	13.83	13.44	14.50	17.00	22.30	23.07	26.03	24.16	17.00
Devon	Genevieve's Gift	1	17.16	15.48	16.87	16.60	16.50	17.76	20.64	18.03	16.60	16.53	17.43
Devon	Genevieve's Gift	2	14.64	14.95	13.50	14.81	15.55	14.41	14.58	15.12	29.43	79.27	16.18
Devon	Ione	1	13.70	16.90	18.63	13.33	19.11	18.61	20.39	18.83	25.35	24.66	16.93
Devon	Ione	2	10.44	13.33	18.40	20.00	20.16	24.33	24.40	33.95	.....	.....	21.00
Guernsey	Madame Select	2	11.63	15.06	14.65	14.00	13.91	14.41	15.70	13.94	13.13	14.90	14.15
Guernsey	Oricle	1	6.20	10.35	14.32	17.00	14.00	14.00	13.64	13.64	13.6	14.08	13.84
Guernsey	Oricle	2	9.41	13.35	14.76	14.23	12.80	11.50	12.30	13.94	15.20	12.17	14.10
Guernsey	Rosette Ford	1	11.74	11.99	15.20	15.46	15.74	17.71	18.05	16.33	12.53	16.18	14.95
Guernsey	Rosette Ford	2	9.36	8.88	10.65	11.30	12.43	15.20	20.54	21.64	25.14	24.90	16.73
Guernsey	Stella Select	1	12.40	14.03	18.40	14.37	18.33	18.40	20.50	21.60	31.06	19.50	17.36
Holstein-Friesian	Beauty Pledge	2	0.29	10.83	11.23	11.80	13.38	14.43	16.92	16.92	23.41	27.94	13.63
Holstein-Friesian	Reck 3d	1	10.10	14.50	14.66	18.25	10.37	16.14	18.18	18.00	22.68	22.68	16.58
Holstein-Friesian	Netherland Constance	1	23.95	17.73	19.70	16.85	17.40	17.40	19.30	17.78	20.43	18.00	16.66
Holstein-Friesian	Ruth	1	14.17	18.81	21.00	21.33	20.45	19.23	21.68	27.48	36.51	23.34	21.34

Jersey .....	1	15.48	17.54	16.10	16.76	18.29	19.45	18.70	16.06	14.40	14.43	16.03
Jersey .....	2	12.78	11.85	12.82	13.11	13.60	14.10	14.84	17.00	16.93	32.30	14.54
Jersey .....	1	11.88	15.11	16.76	16.59	14.87	16.75	17.70	16.68	16.35	16.00	15.75
Jersey .....	2	10.88	11.70	16.46	15.44	11.09	17.50	19.61	20.10	21.65	17.40	16.50
Jersey .....	3	10.10	11.26	1.07	14.78	13.40	11.90	12.70	14.52	14.41	12.74	12.66
Jersey .....	1	13.88	13.00	16.78	13.00	14.74	14.8	14.74	16.53	15.86	15.71	14.54
Jersey .....	2	11.40	0.50	11.85	12.82	12.83	13.92	13.84	18.50	1.60	14.86	13.50
Jersey .....	3	9.18	13.07	12.54	15.10	14.90	14.34	13.00	13.50	16.10	15.50	13.42
Jersey .....	4	10.37	10.20	10.44	11.30	11.63	11.25	11.69	12.12	12.50	14.5	11.50
Jersey .....	1	9.19	13.14	17.35	15.10	17.30	21.63	20.8	18.45	1.67	17.81	6.14
Jersey .....	3	6.93	10.37	11.08	12.10	12.37	12.65	14.30	14.6	15.51	15.53	12.33
Shorthorn .....	1	9.19	12.37	12.03	15.50	15.00	20.10	25.90	18.05	24.75	26.37	18.08
Shorthorn .....	2	8.02	1.64	12.97	14.22	14.35	14.25	15.70	14.65	15.00	14.10	13.30

## AMERICAN HOLDERNESS BUTTER RECORD — MONTHLY AVERAGES OF MAGGIE 6TH — FIRST PERIOD OF LACTATION.

Month of lactation.	DATE.	FROM 100 LBS. OF MILK.			MONTHLY YIELD OF MILK, ETC.				DAILY YIELD.		Per cent. of fat in milk lost.	Per cent of fat in milk re-covered in butter.	Pounds of butter made for one pound of fat in milk.	Cost of food eaten.	Weight of animal.
		Pounds of fat in milk.	Pounds of fat in butter.	Pounds of butter containing 50 per cent. of butter-fat.	Pounds of milk.	Pounds of fat in milk.	Pounds of fat in butter.	Pounds of butter.	Pounds of milk.	Pounds of butter.					
1.....	1890. October.....	3.08	3.53	4.14	506.5	30.92	30.01	23.54	18.3	0.76	4.35	95.65	1.13	\$3.70	726
2.....	November.....	3.36	3.20	3.76	533.3	19.67	16.73	22.02	19.5	0.73	4.76	95.24	1.13	4.74	745
3.....	December.....	3.63	3.47	4.06	532.9	18.96	18.14	21.34	16.9	0.69	4.41	95.59	1.12	4.28	730
4.....	1891. January.....	3.36	3.50	3.76	498.2	16.67	15.78	18.65	15.9	0.60	4.76	95.24	1.12	3.95	731
5.....	February.....	3.18	3.08	3.55	413.0	13.13	13.47	14.66	14.8	0.52	5.03	94.97	1.12	3.54	733
6.....	March.....	3.41	3.25	3.82	449.4	15.32	14.60	17.17	14.5	0.55	4.06	95.31	1.12	3.93	757
7.....	April.....	3.46	3.30	3.86	417.1	14.43	13.76	16.19	13.9	0.54	4.63	95.89	1.12	3.64	763
8.....	May.....	3.63	3.47	4.06	493.1	15.64	14.85	17.47	13.8	0.56	4.41	95.59	1.12	3.82	801
9 ..	June.....	3.87	3.71	4.36	407.6	15.77	15.12	17.78	13.6	0.59	4.13	95.87	1.13	3.66	796
10.....	July.....	3.31	6.15	3.71	416.9	13.80	13.13	15.46	13.5	0.50	4.83	95.17	1.12	3.63	805
		3.49	3.83	3.92	470.2	16.41	15.66	18.42	15.5	0.51	4.59	95.41	1.12	3.89	768

AMERICAN HOLDERNESS BUTTER RECORD — MONTHLY AVERAGES OF MAGGIE 6TH — SECOND PERIOD OF LACTATION.

Month of lactation.	DATE.	FROM 100 LBS. OF MILK.				MONTHLY YIELD OF MILK, ETC.				DAILY YIELD.		Per cent. of fat in milk lost.	Per cent. of fat in milk recovered in butter.	Pounds of butter made for one pound of fat in milk.	Cost of food eaten.	Weight of animal.
		Pounds of fat in milk.	Pounds of fat in butter.	Pounds of butter containing 86 per cent. of butter-fat.	Pounds of milk required to make one pound of butter.	Pounds of milk.	Pounds of fat in milk.	Pounds of butter.	Pounds of butter.	Pounds of milk.	Pounds of butter.					
1.....	1884.															
2.....	May .....	3.72	3.56	4.19	23.87	447.2	16.66	16.93	18.73	14.4	0.60	4.30	96.70	1.13	\$3 09	917
3.....	June.....	4.04	3.88	4.56	21.88	905.9	36.60	35.15	41.33	30.2	1.83	3.96	96.04	1.13	4 82	880
4.....	July .....	3.27	3.11	3.66	27.53	984.3	30.55	29.06	34.19	30.1	1.10	4.89	95.11	1.12	4 48	871
5.....	August .....	3.41	3.25	3.82	26.18	766.1	26.12	24.90	29.27	24.7	0.91	4.69	95.31	1.12	4 76	846
6.....	September.....	3.25	3.09	3.64	27.47	621.1	20.22	19.21	22.63	20.7	0.75	4.92	95.08	1.12	4 55	870
7.....	October .....	3.58	3.43	4.02	24.87	607.3	21.74	20.77	24.43	19.6	0.79	4.47	95.53	1.12	5 34	891
8.....	November .....	3.58	3.43	4.02	24.87	585.0	20.23	19.23	22.72	18.8	0.76	4.47	95.53	1.12	5 64	896
9.....	December .....	3.99	3.83	4.50	22.17	537.5	21.45	20.59	24.20	17.3	0.78	4.01	96.99	1.13	5 17	918
10.....	1883.															
1.....	January .....	4.88	4.22	4.96	20.16	416.4	19.55	18.84	22.15	14.4	0.71	3.65	96.35	1.13	5 00	1004
2.....	February .....	5.06	4.80	5.75	17.20	281.6	14.22	13.77	16.19	10.1	0.53	3.17	96.83	1.14	4 24	1019
3.....		3.72	3.56	4.19	23.87	611.3	23.74	21.76	25.60	20.1	0.84	4 30	95.70	1.13	\$4 72	914

## REPORT OF THE CHEMIST OF THE

AMERICAN HOLLANDERS BUTTER RECORD — MONTHLY AVERAGES OF MAGGIE 6TH — THIRD PERIOD OF LACTATION.

Month of lactation.	DATE.	FROM 100 LBS. OF MILK.				MONTHLY YIELD OF MILK, ETC.				DAILY YIELD.		Per cent. of fat in milk lost.	Per cent. of fat in milk recovered in butter.	Pounds of butter made for one pound of fat in milk.	Cost of food eaten.	Weight of animal.
		Pounds of fat in milk.	Pounds of fat in butter.	Pounds of butter containing 86 per cent. of butter fat.	Pounds of milk required to make one pound of butter.	Pounds of milk.	Pounds of fat in milk.	Pounds of fat in butter.	Pounds of butter.	Pounds of milk.	Pounds of butter.					
1.....	1893.															
2.....	May.....	4.17	4.01	4.73	21.18	480.3	30.03	19.36	22.70	16.0	0.78	3.84	96.16	1.13	\$2.57	833
3.....	June.....	3.85	3.69	4.34	23.04	881.8	22.02	20.69	26.10	27.7	1.31	4.16	96.84	1.13	4.20	835
4.....	July.....	3.38	3.19	3.75	26.67	846.9	26.37	27.02	31.75	27.3	1.03	4.78	95.22	1.12	5.27	834
5.....	August.....	3.90	3.74	4.40	22.73	775.0	30.33	28.99	34.07	26.0	1.10	4.10	96.90	1.13	5.86	833
6.....	September.....	3.62	3.46	4.07	24.57	773.6	28.00	26.77	31.49	25.8	1.05	4.42	95.58	1.12	5.43	867
7.....	October.....	3.85	3.69	4.34	23.04	695.7	26.78	26.67	30.20	22.4	0.97	4.6	96.8	1.13	5.28	879
8.....	November.....	4.17	4.01	4.72	21.18	633.0	36.40	26.38	29.87	21.1	1.00	3.84	96.16	1.13	4.85	935
9.....	December.....	4.20	4.04	4.75	21.05	580.6	24.39	23.46	27.60	18.7	0.89	3.81	96.19	1.13	5.61	1003
10.....	1894.															
1.....	January.....	5.27	5.11	6.01	16.61	266.9	14.07	13.64	16.05	8.6	0.53	3.04	96.96	1.14	5.09	1070
2.....	February.....	6.06	5.89	6.93	14.43	18.7	1.13	1.10	1.30	0.7	0.06	2.65	97.35	1.14	3.55	1118
3.....	March.....	3.98	3.76	4.43	22.62	590.37	25.14	22.19	26.10	19.4	0.86	4.18	95.92	1.13	\$4.77	923

## AMERICAN HOLDFERNES BUTTER RECORD — MONTHLY AVERAGES OF NOEA — FIRST PERIOD OF LACTATION.

Month of lactation.	DATE.	FROM 100 LBS. OF MILK.			Pounds of milk required to make one pound of butter.	MONTHLY YIELD OF MILK, ETC.				DAILY YIELD		Per cent. of fat in milk lost.	Per cent. of fat in milk recovered in butter.	Pounds of butter made for one pound of fat in milk.	Cost of food eaten.	Weight of animal.
		Pounds of fat in milk.	Pounds of fat in butter.	Pounds of butter containing 86 per cent. of butter-fat.		Pounds of milk.	Pounds of fat in milk.	Pounds of fat in butter.	Pounds of butter.	Pounds of milk.	Pounds of butter.					
1.....	1893. December .....	4.80	4.44	5.32	19.15	540.0	24.84	23.93	28.30	17.4	0.91	3.91	96.09	1.13	\$2.50	832
2.....	1894. January .....	3.63	3.52	4.14	24.15	809.1	29.77	25.43	33.50	26.1	1.08	4.35	95.65	1.13	4.17	784
3.....	February .....	3.56	3.40	4.00	25.00	709.3	25.25	24.12	28.36	25.3	1.01	4.49	95.51	1.13	4.14	821
4.....	March .....	3.70	3.54	4.16	24.05	780.5	28.88	27.63	32.50	26.3	1.05	4.32	95.68	1.13	5.00	817
5.....	April .....	3.60	3.44	4.05	24.69	683.4	23.85	22.79	26.82	22.1	0.89	4.44	95.56	1.13	4.30	879
6.....	May .....	3.70	3.54	4.16	21.05	693.3	23.14	22.14	26.05	20.2	0.84	4.33	95.68	1.13	4.09	839
7.....	June .....	3.40	3.24	3.81	26.24	523.7	17.81	16.97	19.95	17.4	0.66	4.71	95.29	1.12	3.62	901
8.....	July .....	3.57	3.41	4.01	24.93	519.6	18.55	17.72	20.64	16.8	0.67	4.48	95.53	1.13	3.86	881
9.....	August .....	3.60	3.44	4.05	24.69	536.0	19.20	18.44	21.70	17.3	0.70	4.46	95.56	1.13	3.85	906
10.....	September .....	3.95	3.79	4.46	23.42	457.8	18.06	17.25	20.40	15.3	0.68	4.05	95.95	1.13	2.93	941
		3.73	3.56	4.19	23.57	616.4	22.95	21.96	25.54	20.3	0.85	4.30	95.70	1.13	\$3.18	862

AYRESHIRE BUTTER RECORD—MONTHLY AVERAGES OF JUNIETTA PEERLESS—SECOND PERIOD OF LACTATION.

Month of lactation.	DATE.	FROM 100 LBS. OF MILK.			Pounds of milk required to make one pound of butter.	MONTHLY YIELD OF MILK, ETC				DAILY YIELD.		Per cent. of fat in milk lost.	Per cent. of fat in milk recovered in butter.	Pounds of butter made for one pound of fat in milk.	Cost of food eaten.	Weight of animal.
		Pounds of fat in milk.	Pounds of butter.	Pounds of butter containing 85 per cent. of butter fat.		Pounds of milk.	Pounds of fat in milk.	Pounds of butter.	Pounds of milk.	Pounds of butter.						
1.....	1892. May.....	4.27	4.11	4.53	20.70	832.7	26.41	35.05	41.21	27.5	1.23	3.75	96.26	1.13	\$3.63	877
2.....	June.....	2.98	2.82	3.22	30.12	903.8	26.57	27.04	31.82	32.0	1.06	5.27	97.63	1.11	5.15	825
3.....	July.....	2.59	2.43	2.86	24.97	906.1	25.02	22.48	27.63	31.2	0.89	6.18	98.82	1.10	5.00	882
4.....	August.....	2.55	2.39	2.81	25.59	863.3	22.14	20.76	24.40	28.0	0.79	6.28	93.72	1.10	5.28	901
5.....	September.....	2.72	2.57	3.02	22.11	789.6	21.56	20.29	21.66	16.3	0.79	5.86	94.14	1.11	5.01	918
6.....	October.....	3.15	2.99	3.52	22.41	809.5	26.50	24.21	23.49	26.1	0.92	5.08	94.92	1.12	6.6	959
7.....	November.....	3.28	3.22	3.79	16.88	742.1	26.08	22.89	26.12	24.7	0.94	4.72	95.27	1.12	6.14	927
8.....	December.....	3.25	3.19	3.75	26.67	678.9	22.64	21.56	25.25	21.8	0.82	4.78	96.22	1.12	5.84	979
9.....	1893. January.....	4.12	3.96	4.56	21.46	465.2	19.16	18.42	21.65	15.0	0.70	3.88	96.12	1.13	4.65	1064
10.....	February.....	4.22	4.16	4.89	20.45	169.7	7.32	7.06	8.30	6.1	0.80	3.70	96.20	1.13	4.10	1087
		2.90	2.84	3.53	28.00	729.8	22.34	22.12	26.10	24.0	0.86	5.00	95.00	1.12	\$5.09	944

AYMSHIRE BUTTER RECORD—MONTHLY AVERAGES OF JUNIETTA PEERLESS—THIRD PERIOD OF LACTATION.

Month of lactation.	DATE.	FROM 100 LBS. OF MILK.			Pounds of milk required to make one pound of butter.	MONTHLY YIELD OF MILK, ETC.				DAILY YIELD.		Per cent. of fat in milk lost.	Per cent. of fat in milk recovered in butter.	Pounds of butter made for one pound of fat in milk.	Cost of food eaten.	Weight of animal.
		Pounds of fat in milk.	Pounds of fat in butter.	Pounds of butter containing 86 per cent. of butter fat.		Pounds of milk.	Pounds of fat in milk.	Pounds of fat in butter.	Pounds of butter.	Pounds of milk.	Pounds of butter.					
1.....	1893. May .....	4.08	3.38	4.61	31.74	976.5	39.84	88.28	45.08	31.5	1.45	3.32	96.06	1.3	\$3.36	882
2.....	June .....	3.24	3.06	3.62	27.63	1055.8	34.31	33.53	38.31	35.2	1.97	4.94	95.06	1.12	4.47	890
3.....	July .....	2.92	2.76	3.25	30.77	1085.0	30.59	29.20	34.27	34.1	1.11	5.48	94.53	1.11	5.13	898
4.....	August .....	3.30	3.04	3.58	27.98	923.6	29.56	28.08	33.05	29.8	1.07	5.00	95.00	1.12	6.10	931
5.....	September .....	2.85	2.60	3.16	31.65	955.5	27.23	25.70	30.22	31.8	1.01	5.61	94.38	1.11	5.03	946
6.....	October .....	3.23	3.07	3.61	27.70	985.4	39.31	33.71	38.73	30.2	1.09	4.95	95.05	1.12	5.63	923
7.....	November .....	3.72	3.55	4.19	23.87	574.8	32.54	31.14	36.64	29.2	1.22	4.70	95.70	1.13	5.66	939
8.....	December .....	3.53	3.38	3.95	26.33	831.1	31.01	29.60	34.90	19.0	1.13	4.55	95.45	1.13	6.12	1019
9.....	1894. January .....	4.05	3.80	4.58	21.83	750.4	30.39	29.19	34.34	34.3	1.11	3.95	96.05	1.13	5.47	1032
10.....	February .....	3.95	3.79	4.46	22.42	463.6	18.51	17.76	20.90	16.7	0.74	4.05	95.95	1.13	4.85	1060
		3.43	3.27	3.85	26.00	868.0	30.44	29.03	34.18	29.1	1.12	4.67	95.33	1.12	5.24	933

AVERSHIRE BUTTER RECORD — MONTHLY AVERAGES OF MANTON BELLE — FIRST PERIOD OF LACTATION.

Mon'th of lactation.	DATE.	FROM 100 LBS. OF MILK.				MONTHLY YIELD OF MILK, ETC.				DAILY YIELD.		Per cent. of fat in milk lost.	Per cent. of fat in milk recovered in butter.	Pounds of butter made for one pound of fat in milk.	Cost of food eaten.	Weight of animal.
		Pounds of fat in milk.	Pounds of fat in butter.	Pounds containing 85 per cent of butter fat.	Pounds of milk required to make one pound of butter.	Pounds of milk.	Pounds of fat in butter.	Pounds of butter.	Pounds of milk.	Pounds of butter.	Pounds of milk.					
1.....	1890. December .....	4.00	3.34	4.52	22.12	533.2	21.33	20.45	24.10	17.8	0.78	4.00	96.00	1.13	\$2.82	976
2.....	1891. January .....	3.10	2.94	3.46	26.80	619.5	20.14	19.10	22.47	21.0	0.72	5.16	94.84	1.12	3.37	886
3.....	February .....	2.83	2.66	3.13	31.95	655.4	18.48	17.43	20.51	23.4	0.73	5.67	94.33	1.11	4.27	896
4.....	March .....	3.42	3.76	3.54	26.01	714.2	24.45	23.29	27.41	23.0	0.88	4.68	95.32	1.12	5.01	916
5.....	April .....	3.40	3.34	3.81	26.24	688.8	23.42	22.32	26.25	23.0	0.87	4.71	95.29	1.12	4.85	938
6.....	May .....	3.28	3.12	3.67	27.25	664.5	21.80	20.74	24.39	21.4	0.79	4.88	95.12	1.12	4.60	929
7.....	June .....	3.36	3.20	3.76	16.60	632.1	21.91	20.87	24.54	21.7	0.81	4.76	96.24	1.12	4.32	973
8.....	July .....	3.23	3.07	3.61	27.70	657.3	21.23	20.18	23.74	21.2	0.77	4.95	95.05	1.13	4.43	955
9.....	August .....	3.42	3.26	3.84	26.04	588.7	20.13	19.19	22.60	19.0	0.75	4.68	96.32	1.12	4.24	1018
10.....	September.....	3.75	3.59	4.22	23.70	454.7	17.43	16.69	19.93	16.5	0.63	4.27	96.73	1.3	4.39	1051
		3.36	3.20	3.76	26.60	626.9	21.03	20.03	21.57	20.6	0.77	4.76	96.34	1.12	\$4.23	964

AYRSHIRE BUTTER RECORD — MONTHLY AVERAGES OF MANTON BELLE — SECOND PERIOD OF LACTATION.

Month of lactation.	DATE.	FROM 100 LBS. OF MILK.			MONTHLY YIELD OF MILK, ETC.				DAILY YIELD.		Per cent. of fat in milk lost.	Per cent. of fat in milk recovered in butter.	Pounds of butter made for one pound of fat in milk	Cost of food eaten.	Weight of animal.
		Pounds of fat in milk.	Pounds of butter.	Pounds of butter containing 82 per cent of butter fat.	Pounds of milk required to make one pound of butter.	Pounds of milk.	Pounds of fat in milk.	Pounds of butter.	Pounds of milk.	Pounds of butter.					
1.....	189..	4.29	4.13	4.86	30.58	880.4	37.77	36.36	42.59	18.4	1.38	8.73	96.27	1.13	1685
2.....	January .....	4.00	3.84	4.58	28.12	873.0	34.88	33.48	39.40	30.1	1.36	4.0	96.00	1.13	1071
3.....	February .....	3.73	3.56	4.19	23.87	843.4	31.37	30.02	35.33	27.2	1.14	4.30	95.70	1.13	1047
4.....	March .....	4.70	4.04	4.75	21.05	789.6	31.06	29.88	35.14	24.7	1.17	3.81	96.19	1.13	1069
5.....	April .....	3.92	3.76	4.42	22.62	738.5	26.95	27.77	32.66	28.8	1.05	4.06	93.92	1.13	1075
6.....	May .....	3.12	2.96	3.48	28.74	747.6	23.32	22.12	26.02	24.9	0.87	5.13	94.87	1.12	1060
7.....	June .....	2.78	2.57	3.02	33.11	629.5	19.10	17.98	21.13	22.6	0.83	5.86	91.14	1.11	1109
8.....	July .....	3.18	3.02	3.55	28.17	467.5	14.86	14.12	16.90	25.1	0.51	5.03	94.57	1.12	1118
9.....	August .....	3.20	3.04	3.53	27.93	259.4	8.30	7.88	9.28	8.7	0.31	5.00	9.00	1.12	1065
10.....	September .....	3.56	3.40	4.00	25.00	66.1	2.35	2.34	2.64	2.1	0.09	4.49	95.51	1.12	1201
	October .....	3.67	3.51	4.13	24.31	631.4	23.20	23.15	26.06	20.7	0.35	4.36	95.64	1.13	1086

**AYRESHIRE BUTTER RECORD — MONTHLY AVERAGES OF MANTON BELLE — THIRD PERIOD OF LACTATION.**

Month of lactation.	DATE.	FROM '00 LBS. OF MILK.			Pounds of milk required to make one pound of butter.	MONTHLY YIELD OF MILK, ETC.				DAILY YIELD.		Per cent. of fat in milk lost.	Per cent. of fat in milk recovered in butter.	Pounds of butter made for one pound of fat in milk.	Cost of food eaten.	Weight of animal.
		Pounds of fat in milk.	Pounds of butter.	Pounds of butter containing 16 per cent. of butter fat.		Pounds of milk.	Pounds of fat in milk.	Pounds of butter.	Pounds of milk.	Pounds of butter.						
1.....	1892. December .....	3.32	3.16	3.72	26.88	1315.1	43.66	41.56	48.91	42.4	1.58	4.82	96.18	1.12	\$6.76	1087
2.....	1893. January .....	3.95	3.79	4.46	22.43	1170.0	46.32	44.26	53.18	37.7	1.63	4.06	96.96	1.13	6.83	1110
3.....	February .....	3.87	3.71	4.36	22.94	893.5	32.32	30.89	36.32	29.7	1.30	4.13	95.87	1.13	5.38	1104
4.....	March .....	3.57	3.41	4.01	24.93	924.1	32.99	31.51	37.06	29.8	1.30	4.48	95.82	1.12	6.25	1115
5.....	April.....	3.90	3.74	4.40	22.78	860.2	33.16	31.80	37.41	28.3	1.25	4.10	95.90	1.13	6.10	1112
6.....	May .....	3.58	3.42	4.02	24.87	786.1	28.11	26.85	31.53	35.3	1.02	4.47	96.53	1.12	6.13	1132
7.....	June.....	3.32	3.16	3.72	26.88	709.4	23.55	22.42	26.38	23.6	0.58	4.82	96.18	1.12	5.70	1143
8.....	July.....	3.22	3.16	3.60	27.78	637.1	21.16	20.11	23.66	21.2	0.76	4.97	96.03	1.12	5.06	1173
9.....	August.....	3.47	3.31	3.89	25.71	532.2	18.12	17.28	20.33	16.8	0.66	4.61	96.39	1.12	5.50	1169
10.....	September .....	3.57	3.41	4.01	24.63	372.1	13.38	12.69	14.33	12.4	0.10	4.48	96.12	1.12	4.71	1196
		3.59	3.43	4.00	25.00	613.8	29.25	27.91	32.53	26.8	1.08	4.46	96.54	1.12	\$5.94	1136

AYRESHIRE BUTTER RECORD — MONTHLY AVERAGES OF MANTON BELLE — FOURTH PERIOD OF LACTATION.

Month of lactation.	DATE.	FROM 100 LBS. OF MILK.			Pounds of milk required to make one pound of butter.	MONTHLY YIELD OF MILK, ETC.				DAILY YIELD.		Per cent. of fat in milk lost.	Per cent. of fat in milk recovered in butter.	Pounds of butter made for one pound of fat in milk.	Cost of food eaten.	Weight of animal.
		Pounds of fat in milk.	Pounds of fat in butter.	Pounds of butter containing 86 per cent. of butter fat.		Pounds of milk.	Pounds of fat in milk.	Pounds of fat in butter.	Pounds of butter.	Pounds of milk.	Pounds of butter.					
1.....	1893. December .....	3.87	3.71	4.56	22.94	787.0	30.46	29.30	34.40	25.4	1.11	4.13	95.87	1.13	\$4.88	1077
2.....	1894. January .....	3.71	3.55	4.18	23.92	844.1	31.32	29.97	35.26	27.2	1.14	4.31	95.69	1.13	4.22	1002
3.....	February .....	3.57	3.41	4.01	24.93	946.0	33.77	32.36	37.93	33.8	1.35	4.43	95.53	1.13	5.08	1018
4.....	March .....	3.15	2.99	3.52	28.41	1053.9	33.36	31.66	37.25	34.2	1.30	5.08	94.93	1.13	5.65	1031
5.....	April .....	3.22	3.06	3.60	27.78	841.4	27.09	25.75	30.30	23.0	1.01	4.97	95.03	1.12	5.20	1053
6.....	May .....	3.35	3.19	3.75	26.67	830.4	27.83	26.50	31.18	26.6	1.00	4.77	95.28	1.12	5.22	1070
7.....	June .....	3.55	3.39	3.99	25.06	723.8	25.69	24.54	28.87	24.1	0.96	4.51	95.49	1.18	4.97	1088
8.....	July .....	3.12	2.96	3.48	28.74	701.3	21.88	20.76	24.42	22.6	0.79	5.13	94.87	1.12	4.31	1076
9.....	August .....	3.55	3.39	3.99	25.06	533.2	19.96	19.06	22.42	18.1	0.72	4.51	95.49	1.12	4.43	1078
10.....	September .....	3.37	3.41	4.01	24.93	430.9	15.35	14.66	17.21	14.3	0.57	4.43	95.53	1.12	3.87	1146
		3.45	3.39	3.87	25.94	773.5	26.67	25.42	29.90	25.4	0.98	4.64	95.35	1.12	\$4.78	1058

AYRSHIRE BUTTER RECORD — MONTHLY AVERAGES OF MISS FLOW 5TH — FIRST PERIOD OF LACTATION.

Month of lactation.	DATE.	FROM 100 LBS OF MILK.				MONTHLY YIELD OF MILK, ETC.				DAILY YIELD.		Per cent. of fat in milk lost.	Per cent. of fat in milk recovered in butter.	Pounds of butter made for one pound of fat in milk.	Cost of food eaten.	Weight of animal.
		Pounds of fat in milk.	Pounds of fat in butter.	Pounds of butter containing 85 per cent. of butter fat.	Pounds of milk required to make one pound of butter.	Pounds of milk.	Pounds of fat in milk.	Pounds of fat in butter.	Pounds of butter.	Pounds of milk.	Pounds of butter.					
1.....	1890. February.....	5.60	5.44	6.40	15.63	442.4	24.77	34.07	38.31	15.8	1.01	2.85	97.15	1.14	\$2 30	736
2.....	March.....	3.96	3.80	4.47	22.30	636.1	34.79	33.78	27.99	10.2	0.90	4.04	96.96	1.13	4 17	803
3.....	April.....	3.91	3.75	4.41	22.69	573.6	23.43	31.51	35.30	19.1	0.81	4.09	96.91	1.13	4 71	800
4.....	May.....	4.00	3.81	4.32	22.13	598.0	23.52	22.56	36.56	19.0	0.86	4.00	96.00	1.13	5 63	869
5.....	June.....	3.80	3.64	4.28	23.36	591.6	22.46	31.53	25.33	19.7	0.84	4.31	96.79	1.13	6 99	873
6.....	July.....	4.11	3.95	4.64	21.55	534.4	31.96	31.11	24.81	17.2	0.80	3.89	96.11	1.13	4 73	866
7.....	August.....	4.05	3.89	4.58	21.83	551.7	23.34	31.46	25.19	17.8	0.81	3.95	96.05	1.13	5 38	874
8.....	September.....	4.37	4.21	4.95	20.30	449.5	19.64	13.92	32.26	16.0	0.74	3.64	16.86	1.13	4 65	916
9.....	October.....	4.34	4.18	4.92	20.32	431.5	18.73	13.04	21.32	13.9	0.68	3.69	96.31	1.13	4 78	903
10.....	November.....	4.35	4.19	5.61	17.73	383.9	16.53	16.00	18.62	11.1	0.63	3.23	96.77	1.14	5 22	937
		4.34	4.08	4.80	20.33	512.3	21.72	30.30	24.60	16.9	0.81	3.77	96.23	1.13	\$1 55	856

AYRESHIRE BUTTER RECORD — MONTHLY AVERAGES OF MILK FLOW 5TH — SECOND PERIOD OF LACTATION.

Month of lactation.	DATE.	FROM 100 LBS. OF MILK.			MONTHLY YIELD OF MILK, ETC.				DAILY YIELD.		Per cent. of fat in milk lost.	Per cent. of fat in milk re-covered in butter.	Pounds of butter made for one pound of fat in milk.	Cost of food eaten.	Weight of animal.
		Pounds of fat in milk.	Pounds of fat in butter.	Pounds of butter containing 86 per cent. of butter fat.	Pounds of milk.	Pounds of fat in milk.	Pounds of fat in butter.	Pounds of butter.	Pounds of milk.	Pounds of butter.					
1.....	1891. March .....	3.87	3.81	4.48	32.32	541.4	31.49	20.61	24.53	17.5	0.78	95.97	1.13	\$2.89	796
2.....	April .....	3.09	2.98	3.45	33.99	581.7	17.37	17.04	30.05	19.4	0.67	94.88	1.12	3.30	798
3.....	May .....	2.93	2.77	3.26	30.67	684.3	18.39	17.29	30.34	20.1	0.66	94.54	1.11	4.50	776
4.....	June .....	3.16	3.00	3.53	32.33	604.8	19.11	18.14	31.24	20.2	0.71	94.94	1.12	4.05	818
5.....	July .....	3.19	3.03	3.56	33.09	566.3	18.06	17.16	30.17	18.3	0.65	94.99	1.12	4.19	812
6.....	August .....	3.47	3.31	3.89	35.71	533.3	18.50	17.65	30.75	17.2	0.67	95.39	1.12	4.13	875
7.....	September.....	3.90	3.74	4.0	32.73	493.3	17.64	16.52	19.89	15.1	0.66	96.90	1.13	4.06	868
8.....	October .....	2.73	2.57	4.30	32.80	455.3	17.01	16.28	19.16	14.7	0.63	95.71	1.13	4.77	923
9.....	November .....	3.77	3.61	4.25	32.53	410.0	15.46	14.80	17.43	13.7	0.58	96.76	1.13	4.65	931
10 .....	December .....	3.57	3.41	4.01	34.93	346.5	13.37	11.82	13.90	11.2	0.45	95.93	1.12	4.80	907
		3.44	3.28	3.86	35.91	511.6	17.60	16.73	19.74	16.8	0.65	96.35	1.12	\$4.04	846

AYRESHIRE BUTTER RECORD — MONTHLY AVERAGES OF MILK FLOW 5TH — THIRD PERIOD OF LACTATION.

Month of lactation.	DATE.	FROM 100 LBS. OF MILK.			MONTHLY YIELD OF MILK, ETC.			DAILY YIELD.		Per cent. of fat in milk lost.	Per cent. of fat in milk recovered in butter.	Pounds of butter made for one pound of fat in milk.	Cost of food eaten.	Weight of animal.
		Pounds of fat in milk.	Pounds of butter.	Pounds of butter containing 86 per cent. of butter fat.	Pounds of milk required to make one pound of butter.	Pounds of milk.	Pounds of fat in milk.	Pounds of butter.	Pounds of milk.					
1.....	1892. May .....	3.97	3.81	4.49	22.33	809.1	22.12	30.88	26.1	1.17	4.03	26.97	\$3 13	917
2.....	June .....	3.00	2.84	3.34	29.94	905.2	27.16	25.71	30.2	1.01	5.33	24.67	4 43	910
3.....	July .....	2.78	2.62	3.03	32.47	917.6	25.51	24.04	29.6	0.91	5.76	24.24	5 01	905
4.....	August .....	3.46	3.30	3.88	25.77	792.7	27.43	26.16	25.6	0.99	4.62	26.38	5 28	936
5.....	September .....	3.19	3.03	3.56	28.69	692.1	22.03	30.97	22.1	0.82	5.01	24.99	5 03	950
6.....	October .....	3.52	3.36	3.93	25.32	715.9	21.20	24.06	23.1	0.91	4.55	26.45	6 19	980
7.....	November .....	3.88	3.72	4.38	22.13	64.0	22.62	22.84	20.5	0.89	4.12	26.38	6 30	973
8.....	December .....	4.20	4.04	4.75	21.05	505.8	21.74	20.43	16.3	0.78	3.81	26.19	6 09	1037
9.....	1893. January .....	4.63	4.47	5.26	19.01	383.9	17.77	17.16	12.4	0.65	3.46	26.54	5 09	1061
10.....	February .....	5.35	5.19	6.10	16.39	199.2	9.05	8.78	6.0	0.37	2.99	27.01	3 89	1108
		3.56	3.40	4.00	25.00	650.7	22.14	22.12	21.4	0.86	4.50	26.50	\$5 08	966

AYRSHIRE BUTTER RECORD — MONTHLY AVERAGES OF MISS FLOW 5TH — FOURTH PERIOD OF LACTATION.

Month of lactation.	DATE.	FROM 100 LBS OF MILK				MONTHLY YIELD OF MILK, ETC.				DAILY YIELD.		Per cent. of fat in milk lost.	Per cent of fat in milk re-covered in butter.	Pounds of butter made for one pound of fat in milk.	Cost of food eaten.	Weight of animal
		Pounds of fat in milk.	Pounds of butter.	Pounds of fat in milk.	Pounds of butter containing 85 per cent of butter fat.	Pounds of milk required to make one pound of butter.	Pounds of milk.	Pounds of fat in milk.	Pounds of butter.	Pounds of milk.	Pounds of butter.					
1.....	1888.	8.77	3.61	4.35	23.53	910.5	34.33	32.87	33.08	29.4	1.35	4.34	95.76	1.13	\$3.87	886
2.....	May.....	8.75	3.59	4.32	23.70	814.9	30.56	29.36	34.40	27.2	1.15	4.27	96.73	1.13	4.98	936
3.....	June.....	3.62	3.76	4.43	22.62	798.4	31.30	30.02	35.31	35.8	1.14	4.08	96.32	1.13	5.02	964
4.....	July.....	3.53	3.36	3.95	35.32	754.0	26.54	25.84	29.80	34.3	0.97	4.55	96.45	1.2	6.6	960
5.....	August.....	3.70	3.54	4.16	34.05	730.0	26.61	25.49	19.97	31.0	1.00	4.12	95.68	1.13	5.61	966
6.....	September.....	4.08	3.92	4.61	31.69	671.8	27.41	26.33	30.98	31.7	1.00	3.92	96.08	1.13	5.62	977
7.....	October.....	4.10	3.94	4.63	31.60	570.4	28.39	22.47	35.43	19.0	0.88	3.90	96.10	1.13	5.36	1044
8.....	November.....	4.15	3.99	4.69	31.33	490.6	29.36	19.58	35.00	15.8	0.74	3.85	96.14	1.13	5.57	1092
9.....	December.....	4.40	4.34	4.99	30.04	390.3	12.77	12.31	14.50	9.4	0.47	3.64	96.36	1.13	5.21	1124
10.....	1894.	4.67	4.51	5.31	18.83	64.0	3.00	2.89	3.40	2.3	0.12	3.43	96.57	1.13	4.02	1171
	January.....	3.88	3.73	4.38	32.83	603.5	23.63	22.64	25.65	30.0	0.86	4.13	96.68	1.13	\$5.16	1015
	February.....															

AYRESHIRE BUTTER RECORD — MONTHLY AVERAGES OF QUEEN DUCHESS — FIRST PERIOD OF LACTATION.

Month of lactation.	DATE.	FROM 100 LBS. OF MILK.			Pounds of milk required to make one pound of butter.	MONTHLY YIELD OF MILK, ETC.				DAILY YIELD.		Per cent. of fat in milk lost.	Per cent. of fat in milk recovered in butter.	Pounds of butter made for one pound of fat in milk.	Cost of food eaten.	Weight of animal.
		Pounds of fat in milk.	Pounds of butter.	Pounds of butter containing 86 per cent. of butter fat.		Pounds of milk.	Pounds of fat in milk.	Pounds of butter.	Pounds of milk.	Pounds of butter.						
1.....	1890. August.....	4.35	4.19	4.98	20.28	805.7	35.05	33.76	39.72	26.0	1.28	3.68	95.38	1.13	\$4.06	760
2.....	September.....	4.48	4.32	5.06	19.68	671.1	30.07	29.00	34.09	23.4	1.14	3.57	96.43	1.13	3.99	765
3.....	October.....	3.93	3.77	4.44	21.52	701.6	27.57	26.45	31.14	22.6	1.01	4.07	96.98	1.13	4.73	741
4.....	November.....	3.95	3.79	4.46	22.42	667.8	26.98	24.98	29.33	21.9	0.96	4.05	96.86	1.13	5.21	755
5.....	December.....	3.78	3.63	4.26	23.48	703.9	26.61	25.48	29.96	22.7	0.97	4.23	95.77	1.13	5.02	756
6.....	1891. January.....	3.60	3.44	4.06	24.69	747.1	26.90	25.71	30.24	24.1	0.96	4.44	95.55	1.13	5.37	756
7.....	February.....	3.31	3.15	3.71	26.95	649.0	21.48	20.42	24.06	23.2	0.86	4.83	93.17	1.12	4.88	760
8.....	March.....	3.86	3.70	4.35	23.00	702.2	27.10	25.96	30.56	22.7	0.99	4.14	96.86	1.13	5.26	788
9.....	April.....	3.73	3.56	4.19	23.87	662.4	24.64	23.56	27.75	22.1	0.93	4.30	96.70	1.13	5.16	804
10.....	May.....	3.67	3.51	4.13	24.21	680.6	25.35	24.25	28.53	22.8	0.92	4.25	96.75	1.13	5.26	836
		3.87	3.71	4.37	22.91	699.1	27.08	25.94	30.55	22.0	1.00	4.15	96.55	1.13	\$4.90	770

AYRESHIRE BUTTER RECORD—MONTHLY AVERAGES OF QUEEN DUCHESS—SECOND PERIOD OF LACTATION.

Month of lactation.	DATE.	FROM 100 LBS. OF MILK.				MONTHLY YIELD OF MILK, ETC.				DAILY YIELD.		Per cent. of fat in milk lost.	Per cent. of fat in milk recovered in butter.	Pounds of butter made for one pound of fat in milk.	Cost of food eaten.	Weight of animal.
		Pounds of fat in milk.	Pounds of fat in butter.	Pounds of butter containing 88 per cent. of butter fat.	Pounds of milk required to make one pound of butter.	Pounds of milk.	Pounds of fat in milk.	Pounds of fat in butter.	Pounds of butter.	Pounds of milk.	Pounds of butter.					
1.....	1891. December .....	3.47	3.31	3.39	25.71	886.6	30.77	29.35	34.51	28.6	1.11	4.61	96.39	1.12	\$3.12	768
2.....	1892. January .....	3.98	3.76	4.42	22.63	916.9	35.94	34.48	40.55	29.6	1.21	4.03	96.32	1.13	5.04	779
3.....	February .....	3.50	3.34	3.93	25.44	864.1	30.34	28.86	33.96	29.8	1.17	4.37	96.45	1.12	5.16	813
4.....	March.....	3.62	3.46	4.07	24.37	873.3	31.53	30.18	35.51	28.1	1.15	4.48	96.58	1.12	5.14	817
5.....	April .....	3.45	3.29	3.87	25.84	854.1	30.47	28.10	33.06	28.5	1.10	4.64	96.36	1.12	5.59	894
6.....	May .....	3.87	3.71	4.56	22.94	835.2	31.93	30.61	36.00	26.6	1.16	4.13	96.57	1.13	5.81	837
7.....	June .....	3.82	3.16	3.72	26.88	773.6	35.65	24.41	23.73	25.8	0.96	4.88	96.18	1.12	5.54	888
8.....	July .....	3.71	3.55	4.18	23.92	701.5	36.02	24.90	29.31	26.6	0.96	4.31	96.69	1.13	5.61	873
9.....	August.....	4.10	3.91	4.63	21.60	415.1	17.14	16.47	19.37	13.5	0.63	8.90	96.10	1.13	4.79	906
10.....	September .....	4.35	4.09	4.81	20.79	187.1	7.95	7.65	9.00	6.2	0.30	3.76	96.94	1.13	4.46	927
		3.66	3.50	4.12	24.37	729.9	36.67	25.55	30.06	22.9	0.99	4.37	96.53	1.12	\$4.93	888

## DEVON BUTTER RECORD — MONTHLY AVERAGES OF AITALIA — FIRST PERIOD OF LACTATION.

Month of lactation.	DATE.	FROM 100 LBS. OF MILK.			MONTHLY YIELD OF MILK, ETC.				DAILY YIELD.		Per cent. of fat in milk lost.	Per cent. of fat in milk recovered in butter.	Pounds of butter made for one pound of fat in milk.	Cost of food eaten.	Weight of animal.
		Pounds of fat in milk.	Pounds of fat in butter.	Pounds of butter containing 86 per cent. of butter fat.	Pounds of milk.	Pounds of fat in milk.	Pounds of fat in butter.	Pounds of butter.	Pounds of milk.	Pounds of butter.					
1.....	1892. January.....	5.18	4.97	5.25	587.1	30.12	29.18	84.34	18.9	1.11	3.12	96.88	1.14	\$3.70	876
2.....	February.....	4.01	3.86	4.53	591.6	22.52	22.77	26.80	20.4	0.93	3.99	96.01	1.13	3.53	849
3.....	March.....	4.53	4.36	5.13	583.7	26.61	25.67	30.20	19.0	0.97	3.54	96.46	1.13	3.78	851
4.....	April.....	4.58	4.42	5.10	583.6	26.81	24.91	29.31	18.8	0.98	3.49	96.51	1.14	3.94	870
5.....	May.....	4.38	4.23	4.96	548.7	24.08	23.15	27.23	17.7	0.88	3.65	96.35	1.13	3.95	851
6.....	June.....	4.20	4.04	4.75	555.3	23.32	22.43	26.36	18.5	0.83	3.81	96.19	1.13	4.49	887
7.....	July.....	3.66	3.53	4.14	536.7	19.38	18.54	21.81	17.0	0.70	4.33	95.67	1.13	4.84	885
8.....	August.....	4.24	4.08	4.80	399.6	16.94	16.30	19.18	12.9	0.62	3.77	96.23	1.13	4.43	889
9.....	September.....	4.06	3.92	4.61	311.6	13.93	13.38	15.75	11.4	0.53	3.93	96.08	1.13	4.10	893
10.....	October.....	4.24	4.08	4.80	311.1	13.19	12.60	14.93	10.0	0.48	3.77	96.23	1.13	5.00	941
		4.33	4.17	4.90	501.4	31.71	30.91	24.60	16.4	0.81	3.70	96.30	1.13	\$4.18	877

## DEVON BUTTER RECORD — MONTHLY AVERAGES OF GENEVIE'S GIFT — FIRST PERIOD OF LACTATION.

Month of lactation.	DATE.	FROM 100 LBS. OF MILK.			MONTHLY YIELD OF MILK, ETC.				DAILY YIELD.		Per cent. of fat in milk lost.	Per cent. of fat in milk recovered in butter.	Pounds of butter made for one pound of fat in milk.	Cost of food eaten.	Weight of animal.
		Pounds of fat in milk.	Pounds of fat in butter.	Pounds of butter containing 85 per cent. of butter fat.	Pounds of milk.	Pounds of fat in milk.	Pounds of butter.	Pounds of fat in butter.	Pounds of milk.	Pounds of butter.					
1.....	1891. May .....	3.35	3.09	3.64	336.0	10.60	10.08	11.87	10.5	0.88	4.92	95.08	1.12	\$3 04	550
2.....	June .....	3.43	3.26	3.64	403.7	13.81	13.16	15.49	13.5	0.59	4.68	96.38	1.12	2 40	560
3.....	July .....	3.99	3.83	4 50	383.1	15.29	14.67	17.25	12.4	0.56	4.01	95.99	1.13	2 91	561
4.....	August .....	4.63	4.53	5.32	386.3	15.27	14.75	17.25	10.5	0.58	3.43	96.58	1.14	2 88	611
5.....	September .....	4.95	4.79	5.64	263.3	13.12	13.70	14.94	8.8	0.49	3.23	96.77	1.14	2.76	634
6.....	October .....	5.58	5.43	6 36	277.9	15.51	15 07	17.73	9.0	0.57	2.87	97.13	1.14	3 15	672
7.....	November .....	5.51	5.35	6.30	243.2	13.40	13.01	15.31	8.1	0.51	2 90	97.10	1.14	3 16	675
8.....	December .....	5.23	5.16	6.07	291.7	15.51	15.04	17.71	9.4	0.57	3.01	96.99	1.14	3 31	715
9.....	1892. January .....	6.15	5.99	7.06	276.1	16.96	16.54	19.46	8.9	0.63	2 50	97.40	1.15	3 27	725
10.....	February .....	6.06	5.90	6.94	255.5	15.45	15.07	17.73	8.8	0.61	2 64	97.36	1.15	2 93	737
		4.75	4.59	5.40	304.9	14.50	14.00	16.47	10.0	0.54	3.37	96.63	1.14	\$3 57	643

## DEVON BUTTER RECORD — MONTHLY AVERAGES OF GENEVIE'S GIFT — SECOND PERIOD OF LACTATION.

Month of lactation.	DATE.	FROM 100 LBS. OF MILK.			MONTHLY YIELD OF MILK, ETC.				DAILY YIELD.		Per cent. of fat in milk lost.	Per cent. of fat in milk recovered in butter.	Pounds of butter made in for one pound of fat in milk.	Cost of food eaten.	Weight of animal.
		Pounds of fat in milk.	Pounds of fat in butter.	Pounds of butter containing 85 per cent.	Pounds of milk.	Pounds of fat in milk.	Pounds of fat in butter.	Pounds of butter.	Pounds of milk.	Pounds of butter.					
1.....	1893. November .....	4.40	4.24	4.99	30.04	591.4	26.02	26.07	39.51	19.7	0.98	3.63	96.37	1.13	84.33
2.....	December .....	5.01	4.85	5.71	17.51	549.8	27.54	26.66	31.88	17.7	1.01	3.19	96.81	1.14	4.66
3.....	1893. January .....	5.66	5.53	6.49	15.41	457.8	26.00	25.37	39.73	14.8	0.96	2.89	97.13	1.14	4.01
4.....	February .....	5.57	5.41	6.36	15.73	404.3	22.53	21.87	25.73	14.4	0.93	2.87	97.13	1.14	3.81
5.....	March .....	5.10	4.94	5.81	17.31	459.3	23.43	22.69	26.68	14.8	0.96	3.14	96.86	1.14	4.15
6.....	April .....	5.37	5.21	6.13	16.31	442.0	23.74	23.08	27.09	14.7	0.90	2.96	97.02	1.14	3.91
7.....	May .....	5.48	5.33	6.26	15.97	437.2	23.96	23.36	27.37	14.1	0.88	2.92	97.08	1.14	3.90
8.....	June .....	5.35	5.19	6.10	16.39	356.4	19.07	18.50	21.75	11.9	0.73	2.99	97.01	1.14	3.29
9.....	July .....	5.40	5.24	6.16	16.23	296.6	13.96	13.45	15.81	8.3	0.51	2.96	97.04	1.14	3.23
10.....	August .....	6.80	6.64	7.51	12.80	53.5	3.97	3.49	4.10	1.7	0.13	2.35	97.65	1.15	3.25
		5.33	5.07	5.96	16.78	400.7	30.97	29.33	33.86	13.3	0.79	3.06	96.94	1.14	93.87
															890

DEVON BUTTER RECORD — MONTHLY AVERAGES OF 100 LBS. — FIRST PERIOD OF LACTATION.

Month of lactation.	DATE.	FROM 100 LBS. OF MILK.				MONTHLY YIELD OF MILK, ETC.				DAILY YIELD.		Per cent. of fat in milk lost.	Per cent. of fat in milk recovered in butter.	Pounds of butter made for one pound of fat in milk.	Cost of food eaten.	Weight of animal.
		Pounds of fat in milk.	Pounds of fat in butter.	Pounds of butter containing 80 per cent of butter fat.	Pounds of milk required to make one pound of butter.	Pounds of milk.	Pounds of fat in milk.	Pounds of fat in butter.	Pounds of butter.	Pounds of milk.	Pounds of butter.					
1.....	1891. March .....	3.84	3.63	4.33	23.09	403.0	15.43	14.84	17.45	13.0	0.56	4.17	95.83	1.13	\$3.29	713
2.....	April.....	4.04	3.53	4.56	31.33	433.9	17.49	16.80	19.75	14.4	0.66	3.96	96.04	1.13	3.36	723
3.....	May .....	3.93	3.77	4.44	32.52	473.7	18.63	17.86	21.03	15.3	0.63	4.07	95.93	1.13	3.91	741
4.....	June .....	3.89	3.73	4.39	33.78	471.3	18.33	17.58	20.69	15.7	0.69	4.11	96.96	1.13	3.76	758
5.....	July .....	3.92	3.76	4.42	33.62	490.4	18.06	17.31	20.35	14.9	0.66	4.08	95.92	1.13	3.89	779
6.....	August .....	4.53	4.37	5.14	19.45	893.4	17.79	17.15	30.17	13.7	0.65	3.53	96.47	1.13	3.76	841
7.....	September.....	4.93	4.77	5.61	17.83	833.5	15.95	15.43	18.15	10.8	0.60	3.25	96.75	1.14	3.70	860
8.....	October.....	4.44	4.33	5.03	19.86	846.0	15.36	14.81	17.41	11.2	0.56	3.60	96.40	*1.13	3.30	868
9.....	November .....	5.57	5.41	6.36	15.72	311.9	17.37	16.87	19.84	10.4	0.66	2.87	97.13	1.14	4.36	909
10.....	December .....	4.66	4.50	5.29	18.90	338.8	15.93	14.79	17.49	10.6	0.56	3.43	96.97	1.14	4.29	931
		4.30	4.14	4.87	20.53	894.4	16.96	16.35	19.24	13.9	0.63	3.73	96.33	1.13	\$3.64	814

## DEVON BUTTER RECORD — MONTHLY AVERAGES OF IONE — SECOND PERIOD OF LACTATION.

Month of lactation.	DATE.	FROM 100 LBS. OF MILK.			Pounds of milk required to make one pound of butter.	MONTHLY YIELD OF MILK, ETC.				DAILY YIELD.		Per cent. of fat in milk lost.	Per cent. of fat in milk recovered in butter.	Pounds of butter made for one pound of fat in milk.	Cost of food eaten.	Weight of animal.
		Pounds of fat in milk.	Pounds of fat in butter.	Pounds of butter containing 85 per cent. of butter fat.		Pounds of milk.	Pounds of fat in milk.	Pounds of fat in butter.	Pounds of butter.	Pounds of milk.	Pounds of butter.					
1.....	1892. July .....	4.30	4.01	4.75	31.03	735.6	20.90	32.73	34.35	23.7	1.12	3.81	96.19	1.13	\$3 65	919
2.....	August .....	4.33	4.12	4.84	30.63	746.1	32.02	30.82	26.33	24.1	1.17	3.74	96.26	1.13	4 46	901
3.....	September .....	3.86	3.70	4.26	23.00	563.8	31.76	30.86	24.53	18.3	0.83	4.15	95.85	1.13	4 51	922
4.....	October .....	4.44	4.23	5.03	19.86	537.4	23.86	13.01	27.04	17.3	0.87	3.60	96.40	1.13	5 40	953
5.....	November .....	4.66	4.40	5.29	18.90	459.7	21.43	30.68	24.33	15.3	0.81	3.43	96.57	1.14	4 90	943
6.....	December .....	4.89	4.73	5.56	17.99	410.1	20.05	19.40	22.81	13.2	0.73	3.37	96.73	1.14	5 56	1019
7.....	1893. January .....	5.33	5.23	6.14	16.39	311.4	16.86	16.36	19.34	10.1	0.63	3.97	97.03	1.14	4 69	1055
8.....	February .....	5 95	5.79	6 81	14 63	185.7	8.07	7 83	9.34	4.8	0.33	2.63	97.31	1.14	3 60	1091
9.....	March .....	5.33	5.16	5.95	16.90	45.2	2.36	2.39	2.70	1.5	0.07	3.06	96.94	1.14	3 04	1133
10.....	April .....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	2 23	1041
		4.50	4.34	5.10	19.60	394.9	17.77	17.14	20.13	13.0	0.66	2.55	96.45	1.14	\$4 30	998

GUERNSEY BUTTER RECORD—MONTHLY AVERAGES OF MADAME SELECT—SECOND PERIOD OF LACTATION.

Month of lactation.	DATE.	FROM 100 LBS. OF MILK.			POUNDS OF MILK REQUIRED TO MAKE ONE POUND OF BUTTER.			MONTHLY YIELD OF MILK, ETC.				DAILY YIELD.		Per cent. of fat in milk lost.	Per cent. of fat in milk recovered in butter.	Pounds of butter made for one pound of fat in milk.	Cost of food eaten.	Weight of animal.
		Pounds of fat in milk.	Pounds of fat in butter.	Pounds of butter containing 85 per cent. of butter fat.	Pounds of milk required to make one pound of butter.	Pounds of milk.	Pounds of fat in milk.	Pounds of butter.	Pounds of butter.	Pounds of milk.	Pounds of butter.	Pounds of milk.	Pounds of butter.					
1.....	1892. October.....	5.50	5.84	6.28	15.92	554.2	31.03	30.13	35.41	18.3	1.14	2.91	97.09	1.14	97.09	1.14	\$4.12	753
2.....	November.....	5.79	5.63	6.62	15.10	531.7	33.66	32.76	38.51	19.4	1.38	2.76	97.34	1.14	97.34	1.14	5.80	770
3.....	December.....	6.31	6.15	7.24	13.81	551.6	34.81	33.92	39.92	17.8	1.39	2.53	97.47	1.15	97.47	1.15	5.85	803
4.....	1893. January.....	6.47	6.31	7.42	13.47	499.3	32.30	31.51	37.06	6.1	1.19	2.47	97.53	1.15	97.53	1.15	5.17	837
5.....	February.....	6.90	6.74	7.92	12.63	480.9	29.04	28.37	33.35	15.0	1.18	2.32	97.63	1.15	97.63	1.15	4.64	831
6.....	March.....	6.50	6.34	7.46	13.40	474.4	30.84	30.08	35.39	15.4	1.14	2.46	97.54	1.15	97.54	1.15	5.10	853
7.....	April.....	5.92	5.76	6.78	14.75	442.8	26.21	25.51	30.01	14.8	1.00	2.70	97.80	1.15	97.80	1.15	4.72	865
8.....	May.....	6.13	5.97	7.02	14.25	463.1	28.39	27.65	33.51	14.9	1.05	2.61	97.39	1.15	97.39	1.15	4.53	883
9.....	June.....	6.02	5.86	6.99	14.52	385.6	23.21	22.60	28.57	12.9	0.89	2.66	97.34	1.14	97.34	1.14	3.59	872
10.....	July.....	5.98	5.76	6.78	14.75	386.5	22.89	22.36	29.90	13.5	0.85	2.70	97.20	1.15	97.20	1.15	3.90	896
		6.13	5.97	7.02	14.25	477.0	29.94	28.48	33.50	15.7	1.10	2.61	97.39	1.15	97.39	1.15	\$4.74	834

## GUERNSEY BUTTER RECORD—MONTHLY AVERAGES OF ORIOLE—FIRST PERIOD OF LACTATION.

Month of lactation.	DATE.	FROM 100 LBS OF MILK.				MONTHLY YIELD OF MILK, ETC.				DAILY YIELD.		Per cent. of fat in milk lost	Per cent of fat in milk recovered in butter.	Pounds of butter made for one pound of fat in milk.	Cost of food eaten.	Weight of animal.
		Pounds of fat in milk.	Pounds of fat in butter.	Pounds of butter containing 86 per cent of butter fat.	Pounds of milk required to make one pound of butter.	Pounds of milk.	Pounds of fat in milk.	Pounds of fat in butter.	Pounds of butter.	Pounds of milk.	Pounds of butter.					
1.....	1890. December.....	6.87	6.71	7.89	13.67	486.1	39.06	39.96	34.43	14.1	1.11	2.33	97.67	1.15	\$3 17	686
2.....	1891. January.....	4.94	4.78	5.63	17.79	440.0	21.74	31.03	24.74	14.2	0.80	2.34	96.76	1.14	2 62	687
3.....	February.....	4.49	4.33	5.09	19.65	478.4	21.48	30.71	24.26	17.1	0.87	2.56	96.44	1.13	3 49	634
4.....	March.....	4.36	4.30	4.94	20.34	536.3	23.38	32.52	26.50	17.3	0.85	2.67	96.33	1.13	4 50	649
5.....	April.....	4.89	4.73	5.56	17.99	557.3	27.35	36.36	31.01	18.6	1.03	2.27	96.73	1.11	4 35	608
6.....	May.....	4.83	4.67	5.49	18.22	581.3	28.08	37.15	31.94	18.8	1.03	2.31	96.69	1.14	4 47	692
7.....	June.....	4.85	4.69	5.51	18.12	568.3	27.07	36.18	30.80	18.6	1.03	2.30	96.70	1.14	4 17	697
8.....	July.....	4.95	4.79	5.61	17.74	577.9	28.61	37.63	32.56	18.6	1.05	2.28	96.77	1.14	4 24	683
9.....	August.....	5.11	4.95	5.82	17.18	560.9	28.66	37.76	32.66	18.1	1.05	2.13	96.87	1.14	4 13	737
10.....	September.....	5.30	5.13	6 04	16.56	476.3	25.14	34.38	28.70	15.8	0.96	2.03	96.98	1.14	4 04	739
		5.03	4.86	5.72	17.43	590.17	26.14	36.33	29.75	17.1	0.96	2.19	96.81	1.14	\$3 33	680

GUERNSEY BUTTER RECORD — MONTHLY AVERAGES OF ORICLE — SECOND PERIOD OF LACTATION.

Month of lactation.	DATE.	FROM 100 LBS. OF MILK.				MONTHLY YIELD OF MILK, ETC.				DAILY YIELD.		Per cent. of fat in milk lost.	Per cent. of fat in milk recovered in butter.	Pounds of butter made for one pound of fat in milk.	Cost of food eaten.	Weight of animal.
		Pounds of fat in milk.	Pounds of fat in butter.	Pounds of butter containing 85 per cent. of butter fat.	Pounds of milk required to make one pound of butter.	Pounds of milk.	Pounds of fat in milk.	Pounds of fat in butter.	Pounds of butter.	Pounds of milk.	Pounds of butter.					
1.....	1892. December .....	5.67	5.51	6.46	15.43	523.9	29.71	28.87	33.96	16.9	1.10	2.82	97.18	1.14	\$3.21	775
2.....	1893. January .....	5.07	4.91	5.73	17.30	733.8	37.30	36.03	42.40	23.7	1.37	3.16	96.84	1.14	5.63	886
3.....	February .....	5.37	5.21	6.13	16.31	630.2	33.64	32.83	35.63	22.5	1.36	2.98	97.02	1.14	5.70	8.7
4.....	March .....	5.60	5.44	6.40	15.62	661.2	37.03	35.97	42.30	21.3	1.36	2.56	97.14	1.14	6.03	873
5.....	April .....	5.37	5.21	6.13	16.31	679.5	33.80	32.80	38.60	21.0	1.39	2.98	97.02	1.14	4.93	895
6.....	May .....	5.37	5.71	6.72	14.58	646.5	37.55	36.92	43.44	20.9	1.40	2.73	97.37	1.14	5.00	593
7.....	June .....	5.35	5.19	6.11	16.37	561.2	30.02	29.13	34.27	18.7	1.14	2.99	97.01	1.14	4.11	833
8.....	July .....	5.17	5.01	5.89	16.93	558.9	29.89	28.60	32.94	18.0	1.06	3.09	96.91	1.14	4.36	835
9.....	August .....	5.36	5.09	5.99	16.69	540.6	28.38	27.52	32.33	17.6	1.04	3.05	96.95	1.14	4.32	873
10.....	September .....	5.45	5.39	6.32	16.03	530.2	28.90	28.05	33.00	17.7	1.10	2.94	97.06	1.14	4.05	892
		5.42	5.26	6.19	16.16	601.6	32.61	31.64	37.32	19.8	1.22	2.65	97.05	1.14	\$4.80	865

## GUERNSEY BUTTER RECORD — MONTHLY AVERAGES OF ROSETTE FORD — FIRST PERIOD OF LACTATION.

Month of lactation.	DATE.	FROM 100 LBS. OF MILK.			MONTHLY YIELD OF MILK, ETC.				DAILY YIELD.		Per cent. of fat in milk lost.	Per cent. of fat in milk recovered in butter.	Pounds of butter made for one pound of fat in milk	Cost of food eaten.	Weight of animal.
		Pounds of fat in milk.	Pounds of fat in butter.	Pounds of butter containing 86 per cent. of butter fat.	Pounds of milk.	Pounds of fat in milk.	Pounds of fat in butter.	Pounds of butter.	Pounds of milk.	Pounds of butter.					
1.....	1890. November.....	5.40	5.24	6.16	300.0	21.06	20.44	24.03	13.0	0.86	2.96	97.04	1.14	\$3.83	851
2.....	December.....	5.32	5.16	6.07	543.4	28.91	28.04	32.99	17.5	1.06	3.01	96.99	1.14	3.83	941
3.....	1891. January.....	4.74	4.58	5.39	531.5	26.63	25.72	30.26	18.1	0.98	3.27	96.63	1.14	4.60	949
4.....	February.....	4.90	4.74	5.58	482.3	23.63	22.66	26.89	17.2	0.96	3.27	96.73	1.14	4.16	943
5.....	March.....	5.12	4.96	5.84	501.9	25.70	24.90	29.28	16.2	0.94	3.13	96.87	1.14	4.61	893
6.....	April.....	5.02	4.86	5.72	478.8	24.04	23.27	27.38	16.0	0.91	3.19	96.81	1.14	4.85	893
7.....	May.....	4.81	4.65	5.47	515.9	24.81	23.99	28.22	16.6	0.91	3.33	96.67	1.14	4.53	873
8.....	June.....	4.76	4.60	5.41	476.1	22.66	21.90	25.76	15.9	0.86	3.26	96.64	1.14	4.18	885
9.....	July.....	4.73	4.57	5.38	483.7	21.98	21.19	24.94	15.0	0.80	3.38	96.63	1.14	3.20	876
10.....	August.....	4.98	4.82	5.67	482.0	22.51	21.79	25.63	14.6	0.83	3.21	96.79	1.14	4.13	923
		4.97	4.81	5.66	466.6	24.19	23.41	27.54	16.0	0.91	3.23	96.73	1.14	\$4.09	885

GUERNSEY BUTTER RECORD — MONTHLY AVERAGES OF ROSETTE FORD — SECOND PERIOD OF LACTATION.

Month of lactation.	DATE.	FROM 100 LBS OF MILK			MONTHLY YIELD OF MILK, ETC.				DAILY YIELD.		Per cent. of fat in milk lost.	Per cent. of fat in milk recovered in butter.	Pounds of butter made for one pound of fat in milk.	Cost of food eaten.	Weight of animal.
		Pounds of fat in milk.	Pounds of fat in butter.	Pounds of butter containing 85 per cent. of butter fat.	Pounds of milk required to make one pound of butter.	Pounds of milk.	Pounds of fat in milk.	Pounds of butter.	Pounds of milk.	Pounds of butter.					
1.....	1898. February .....	5.32	5.15	6.07	16.47	698.6	37.17	38.05	24.9	1.51	3.01	96.99	1.14	\$3.96	945
2.....	March .....	5.55	5.39	6.31	15.77	1019.2	56.56	54.93	33.9	2.08	2.97	97.03	1.14	5.74	944
3.....	April .....	5.37	5.11	6.01	16.44	918.5	48.40	46.94	30.6	1.84	3.04	96.96	1.14	5.87	933
4.....	May .....	5.57	5.41	6.36	15.72	890.0	45.67	44.36	26.5	1.63	2.87	97.13	1.14	5.89	933
5.....	June .....	5.97	5.81	6.84	14.62	674.2	49.25	39.17	22.5	1.53	2.63	97.33	1.15	5.73	935
6.....	July .....	5.70	5.54	6.52	15.34	532.9	30.88	32.52	17.2	1.12	2.81	97.19	1.15	5.33	938
7.....	August .....	6.17	6.01	7.07	14.14	424.9	26.32	25.53	13.7	0.97	2.59	97.41	1.15	6.17	1035
8.....	September .....	6.53	6.49	7.64	13.09	430.5	28.63	27.94	14.4	1.10	2.41	97.59	1.15	5.44	1049
9.....	October .....	6.23	6.07	7.14	14.00	304.7	18.98	19.50	9.8	0.70	2.87	97.43	1.14	5.47	1040
10.....	November .....	6.26	6.09	7.16	13.97	299.5	18.09	17.63	9.7	0.69	2.56	97.44	1.15	5.37	1132
		5.73	5.57	6.55	15.27	611.3	35.04	34.05	30.2	1.32	2.80	97.30	1.15	\$5.50	998

## GUERNSEY BUTTER RECORD — MONTHLY AVERAGE OF SIELLA SELECT — FIRST PERIOD OF LACTATION.

Month of lactation.	DATE.	FROM 100 LBS. OF MILK				MONTHLY YIELD OF MILK, ETC.				DAILY YIELD.		Per cent. of fat in milk lost.	Per cent. of fat in milk recovered in butter.	Pounds of butter made for one pound of fat in milk.	Cost of food eaten.	Weight of animal.
		Pounds of fat in milk.	Pounds of fat in butter.	Pounds of butter containing 85 per cent. of butter fat.	Pounds of milk required to make one pound of butter.	Pounds of milk.	Pounds of fat in milk.	Pounds of fat in butter.	Pounds of butter.	Pounds of milk.	Pounds of butter.					
1.....	1892. March .....	3.94	3.78	4.45	23.47	743.0	29.27	28.08	33.06	24.0	1.07	4.06	95.94	1.13	\$4 10	755
2.....	April .....	4.14	3.98	4.63	21.37	636.6	26.35	25.33	29.79	21.2	0.99	3.86	96.14	1.13	4 18	761
3.....	May .....	3.95	3.79	4.46	22.42	602.4	26.79	22.53	26.86	19.4	0.87	4.06	91.95	1.13	4 40	781
4.....	June .....	4.55	4.29	5.16	19.38	610.9	27.79	26.81	31.53	20.4	1.05	3.52	96.48	1.13	4 50	769
5.....	July .....	3.67	3.51	4.13	24.21	616.0	23.61	21.63	25.44	9.9	0.82	4.86	96.64	1.13	4 66	797
6.....	August .....	4.30	4.14	4.87	10.53	598.0	22.62	21.76	25.62	17.0	0.83	3.72	96.28	1.13	4 72	814
7.....	September .....	4.81	4.65	5.47	18.26	397.7	19.13	18.49	21.76	13.3	0.72	3.38	96.67	1.14	4 46	894
8.....	October .....	5.15	4.99	5.87	17.04	432.7	21.77	21.09	24.81	13.6	0.80	3.11	95.89	1.14	5 26	866
9.....	November .....	5.86	5.70	6.70	14.92	383.2	23.45	21.84	25.67	12.8	0.86	2.73	97.27	1.14	5 41	865
10.....	December .....	6.31	6.15	7.94	13.81	394.7	24.90	24.27	28.56	12.7	0.92	2.54	97.46	1.15	5 57	926
		4.51	4.36	5.12	19.53	533.3	24.07	23.90	27.30	17.4	0.89	3.55	96.45	1.13	\$4 74	815

HOLSTEIN-FRIESIAN BUTTER RECORD — MONTHLY AVERAGES OF BEAUTY PLEDGE — SECOND PERIOD OF LACTATION.

Month of lactation.	DATE.	FROM 100 LBS. OF MILK.				MONTHLY YIELD OF MILK, ETC.				DAILY YIELD.		Per cent. of fat in milk lost.	Per cent. of fat in milk recovered in butter.	Pounds of butter made for one pound of fat in milk.	Cost of food eaten.	Weight of animal.
		Pounds of fat in milk.	Pounds of fat in butter.	Pounds of butter containing 86 per cent. of butter fat.	Pounds of milk required to make one pound of butter.	Pounds of milk.	Pounds of fat in milk.	Pounds of fat in butter.	Pounds of butter.	Pounds of milk.	Pounds of butter.					
1.....	1893. December.....	4.28	4.12	4.86	20.63	750.0	32.08	30.90	36.35	24.2	1.17	3.74	96.26	1.13	\$3 74	1069
2.....	1894. January.....	4.14	3.98	4.68	21.37	1197.4	49.57	47.67	56.00	38.6	1.81	3.86	96.14	1.13	6 06	1069
3.....	February.....	3.76	3.60	4.28	23.64	1219.0	45.83	43.88	51.63	43.5	1.84	4.26	96.74	1.13	5 79	1071
4.....	March.....	3.70	3.54	4.16	24.06	1364.5	50.49	48.30	54.83	44.0	1.83	4.32	95.63	1.13	6 71	1065
5.....	April.....	3.49	3.36	3.84	26.04	1135.8	38.84	37.08	43.56	37.9	1.46	4.68	96.33	1.12	5 83	1074
6.....	May.....	3.45	3.29	3.87	26.84	994.0	34.29	32.70	38.47	32.1	1.34	4.64	95.36	1.12	5 55	1070
7.....	June.....	3.20	3.04	3.58	27.93	793.0	25.88	24.11	28.37	28.4	0.93	5.00	95.00	1.13	4 80	1106
8.....	July.....	3.97	3.81	4.46	23.33	598.9	20.20	19.39	22.81	16.4	0.73	4.08	95.97	1.13	3 70	1082
9.....	August.....	4.00	3.84	4.53	22.12	436.4	17.06	16.37	19.26	13.8	0.62	4 00	96.00	1.13	4 51	1110
10.....	September.....	5.27	5.11	6.01	16.61	170.9	9.01	8.73	10.27	5.7	0.34	3.24	96.76	1.14	2 86	1144
		3.77	3.61	4.25	23.53	856.0	23.26	20.90	26.36	23.1	1.30	4.25	96.75	1.13	\$4 96	1086

## HOLSTEIN-FRIESIAN BUTTER RECORD — MONTHLY AVERAGES OF ESSEL 2D — FIRST PERIOD OF LACTATION.

Month of lactation.	DATE.	FROM 100 LBS. OF MILK.			Pounds of milk required to make one pound of butter.	MONTHLY YIELD OF MILK, ETC.					DAILY YIELD.		Per cent. of fat in milk lost.	Per cent. of fat in milk recovered in butter.	Pounds of butter made for one pound of fat in milk.	Cost of food eaten.	Weight of animal.
		Pounds of fat in milk.	Pounds of butter.	Pounds of butter containing 88 per cent. of butter fat.		Pounds of milk.	Pounds of fat in milk.	Pounds of butter.	Pounds of milk.	Pounds of butter.							
1.....	1890.	4.86	4.70	5.53	18.08	651.0	31.61	30.60	36.00	21.0	1.16	3.29	96.71	1.14	\$3 64	968	
2.....	July .....	3.64	3.48	4.09	24.45	884.0	32.18	30.77	36.17	23.5	1.17	4.49	95.60	1.12	5 24	978	
3.....	August .....	3.86	3.70	4.35	23.00	895.0	34.55	33.12	38.26	29.8	1.29	4.15	95.85	1.13	5 67	1042	
4.....	September .....	3.64	3.48	4.09	24.45	780.6	28.41	27.16	31.94	15.2	1.03	4.40	96.60	1.12	5 33	1018	
5.....	October .....	3.66	3.50	4.12	24.27	750.5	27.47	26.27	30.91	25.0	1.03	4.37	95.63	1.13	5 06	1051	
6.....	November .....	3.92	3.76	4.42	22.62	725.1	28.42	27.56	32.06	23.4	1.03	4.08	95.92	1.13	5 81	1053	
7.....	December .....	3.55	3.39	3.99	25.06	790.1	28.05	26.79	31.83	15 5	1.02	4.51	95.49	1.12	5 73	1033	
8.....	1891.	3.73	3.57	4.20	23.80	655.8	24.46	23.41	27.54	23.4	0.98	4.29	96.71	1.13	5 12	1044	
9.....	January .....	3.91	3.75	4.41	22.69	638.1	24.95	23.98	28.15	20.6	0.91	4.09	96.91	1.13	5 09	1066	
10.....	February .....	3.96	3.79	4.46	22.42	544.7	21.52	20.65	24.29	18.2	0.81	4.06	95.95	1.13	5 48	1670	
	March .....																
	April .....	3.85	3.69	4.31	23.01	731.5	26.17	27.00	31.77	24.1	1.01	4.15	95.85	1.13	\$5 27	1021	

HOLSTEIN-FRIESIAN BUTTER RECORD—MONTHLY AVERAGES OF NETHERLAND CONSTANCE—FIRST PERIOD OF LACTATION.

Month of lactation.	DATE.	FROM 100 LBS. OF MILK.				MONTHLY YIELD OF MILK, ETC.				DAILY YIELD.		Per cent. of fat in milk lost.	Per cent. of fat in milk recovered in butter.	Pounds of butter made in one pound of fat in milk.	Cost of food eaten.	Weight of animal.
		Pounds of fat in milk.	Pounds of fat in butter.	Pounds of butter containing 85 per cent.	Pounds of milk required to make one pound of butter.	Pounds of milk.	Pounds of fat in milk.	Pounds of fat in butter.	Pounds of butter.	Pounds of milk.	Pounds of butter.					
1.....	1893. October .....	2.70	2.54	2.99	33.44	793.0	19.76	18.59	21.88	94.4	0.71	5.93	94.07	1.19	\$5.94	999
2.....	November .....	2.77	2.61	3.07	33.57	1090.3	30.30	28.46	33.47	86.3	1.12	5.78	94.32	1.11	5.96	925
3.....	December .....	2.56	2.40	2.83	35.46	1163.1	29.90	28.03	33.96	37.7	1.06	6.35	93.75	1.10	6.53	1032
4.....	1893. January .....	2.97	2.81	3.31	30.21	1090.5	31.50	29.80	35.08	34.2	1.13	5.39	94.61	1.11	5.91	1033
5.....	February .....	3.22	3.06	3.60	27.78	950.5	30.61	29.09	34.22	33.9	1.22	4.97	95.03	1.12	5.86	1073
6.....	March .....	3.35	3.19	3.75	26.67	999.3	33.46	31.88	37.48	33.2	1.21	4.78	95.22	1.12	6.51	1099
7.....	April .....	2.87	2.71	3.19	31.36	947.8	27.30	26.63	30.23	31.6	1.01	5.67	94.43	1.11	5.80	1087
8.....	May .....	3.00	2.84	3.34	29.94	892.5	26.79	25.26	29.81	28.8	0.96	5.33	94.67	1.11	5.30	1069
9.....	June .....	3.00	2.84	3.34	29.94	799.1	23.67	22.41	26.36	26.3	0.88	5.33	94.67	1.11	5.39	1068
10.....	July .....	2.90	2.74	3.22	31.06	887.5	24.00	22.63	23.66	26.7	0.85	5.52	94.48	1.11	4.99	1005
		2.93	2.77	3.26	30.67	945.8	27.71	26.30	30.82	31.1	1.01	5.46	94.54	1.11	\$5.75	1043

## REPORT OF THE CHEMIST OF THE

## HOLSTEIN-FRIESIAN BUTTER RECORD — MONTHLY AVERAGES OF RUTH — FIRST PERIOD OF LACTATION.

Month of lactation.	DATE.	FROM 100 LBS. OF MILK.				Pounds of milk required to make one pound of butter.	MONTHLY YIELD OF MILK, ETC.				DAILY YIELD.		Per cent. of fat in milk lost.	Per cent. of fat in milk recovered in butter.	Pounds of butter made for one pound of fat in milk.	Cost of food eaten.	Weight of animal.
		Pounds of fat in milk.	Pounds of fat in butter.	Pounds of butter containing 86 per cent of butter fat.	Pounds of milk.		Pounds of milk.	Pounds of fat in milk.	Pounds of butter.	Pounds of milk.	Pounds of butter.						
1.....	1903. December .....	2.89	2.66	3.13	31.95	877.3	24.74	23.24	27.45	28.3	0.89	5.67	94.23	1.11	\$3.89	1094	
2.....	1904. January .....	2.79	2.63	3.09	28.26	941.4	26.27	24.76	29.13	30.4	0.94	5.73	94.27	1.11	5.48	1090	
3.....	February .....	2.68	2.53	2.95	33.73	795.9	21.33	20.06	23.00	23.4	0.84	5.93	94.03	1.11	5.10	1133	
4.....	March .....	2.90	2.74	3.22	31.06	849.0	24.63	23.26	27.35	27.4	0.88	5.53	94.45	1.11	5.84	1140	
5.....	April, .....	2.95	2.79	3.26	30.49	659.5	20.34	19.24	22.64	23.0	0.75	5.43	94.55	1.11	4.63	1164	
6.....	May .....	3.05	2.80	3.40	29.41	633.2	19.31	18.30	21.53	20.4	0.69	5.25	94.75	1.12	4.16	1190	
7.....	June .....	2.90	2.74	3.22	31.06	588.4	15.61	14.75	17.35	17.9	0.58	5.52	94.46	1.11	3.71	1180	
8.....	July .....	2.92	2.76	3.25	30.77	480.4	12.57	11.88	14.00	13.9	0.45	5.48	94.53	1.11	3.84	1208	
9.....	August .....	2.95	2.79	3.26	30.49	355.2	10.51	9.94	11.70	11.5	0.38	5.42	94.53	1.11	4.19	1217	
10.....	September .....	3.25	3.09	3.64	27.47	325.6	7.36	7.00	8.25	7.5	0.27	4.92	95.06	1.12	2.23	1227	
		2.88	2.72	3.20	31.25	633.6	12.37	17.24	20.23	20.8	0.67	5.50	94.50	1.11	\$4.22	1154	

## JERSEY BUTTER REC RD — MONTHLY AVERAGES OF ALBERT'S CAROL — FIRST PERIOD OF LACTATION.

Month of lactation.	DATE.	FROM 100 LBS. OF MILK.				MONTHLY YIELD OF MILK, ETC.				DAILY YIELD.		Per cent. of fat in milk lost.	Per cent. of fat in milk recovered in butter.	Pounds of butter made for one pound of fat in milk.	Cost of food eaten.	Weight of animal.
		Pounds of fat in milk.	Pounds of fat in butter.	Pounds of butter containing 85 per cent. of butter fat.	Pounds of milk required to make one pound of butter.	Pounds of milk.	Pounds of fat in milk.	Pounds of fat in butter.	Pounds of butter.	Pounds of milk.	Pounds of butter.					
1.....	1893. May .....	3.99	3.83	4.50	22.17	603.6	24.08	23.12	27.18	19.5	0.83	4.01	96.99	1.13	\$4.21	641
2.....	June .....	4.57	4.41	5.19	19.97	553.6	25.30	24.41	28.73	18.5	0.96	3.50	96.50	1.14	5.04	615
3.....	July .....	4.28	4.13	4.84	20.66	554.0	23.71	22.83	26.83	17.9	0.87	3.74	96.26	1.13	4.28	633
4.....	August.....	4.64	4.48	5.27	18.98	469.7	21.79	21.04	24.75	15.2	0.80	3.45	96.55	1.14	4.15	648
5.....	September.....	4.60	4.44	5.22	19.16	433.6	19.96	19.26	22.64	14.5	0.75	3.43	96.58	1.13	4.14	659
6.....	October.....	5.13	4.97	5.85	17.09	438.5	22.49	21.79	25.65	14.1	0.83	3.12	96.88	1.14	5.00	668
7.....	November.....	5.78	5.62	6.61	15.13	433.2	24.93	24.29	28.87	14.4	0.96	2.77	97.23	1.14	5.94	690
8.....	December.....	6.35	6.19	7.28	13.75	484.6	27.60	26.90	31.65	14.0	1.02	2.53	97.48	1.15	5.07	733
9.....	1893. January.....	6.50	6.34	7.46	13.40	439.9	27.94	27.25	32.07	13.9	1.03	2.46	97.54	1.15	4.93	755
10.....	February.....	7.05	6.89	8.11	12.33	374.4	26.40	25.80	30.36	13.4	1.08	2.27	97.73	1.15	4.28	780
		5.17	5.01	5.89	17.00	473.4	24.43	23.67	27.86	15.5	0.93	3.10	96.90	1.14	\$4.63	680

## JERSEY BUTTER RECORD—MONTHLY AVERAGES OF ALBERT'S CAROL—SECOND PERIOD OF LACTATION.

Month of lactation.	DATE.	FROM 100 LBS. OF MILK.			Pounds of milk required to make one pound of butter.	MONTHLY YIELD OF MILK, ETC.			DAILY YIELD.		Per cent. of fat in milk lost.	Per cent. of fat in milk recovered in butter.	Pounds of butter made for one pound of fat in milk.	Cost of food eaten.	Weight of animal.
		Pounds of fat in milk.	Pounds of fat in butter.	Pounds of butter containing 86 per cent. of butter fat.		Pounds of milk.	Pounds of fat in milk.	Pounds of butter.	Pounds of milk.	Pounds of butter.					
1.....	1893. November .....	5.17	5.01	5.89	16.96	432.3	31.63	31.16	14.1	0.83	3.09	96.91	1.14	\$3 18	754
2.....	December .....	6.13	5.96	7.01	14.37	533.1	33.93	32.07	17.4	1.33	2.62	97.86	1.15	4 47	797
3.....	1894. January .....	5.97	5.81	6.84	14.62	565.0	33.73	32.53	18.3	1.24	2.68	97.32	1.15	4 96	800
4.....	February .....	6.07	5.91	6.96	14.19	505.7	30.70	29.99	18.0	1.36	2.61	97.86	1.15	4 61	846
5.....	March .....	6.17	6.01	7.07	14.14	593.4	33.33	32.36	17.4	1.23	2.59	97.41	1.15	5 17	844
6.....	April .....	6.15	5.99	7.05	14.18	468 1	28.79	28.05	15.6	1.10	2.60	97.40	1.15	4 65	876
7.....	May .....	5.76	5.59	6.53	15.19	473.3	27.50	26.74	15.4	1.01	2.78	97.33	1.14	4 67	897
8.....	June .....	5.35	5.19	6.10	16.29	369.5	19.77	19.18	12.3	0.75	2.99	97.01	1.14	3 88	864
9.....	July .....	5.82	5.66	6.66	15.01	315.7	19.37	17.87	10.1	0.87	2.76	97.35	1.14	3 56	871
10.....	August .....	5.17	5.01	5.99	16.98	184.8	9.55	9.36	5.9	0.85	3.10	96.90	1.14	3 33	895
		5.85	5.69	6.70	14.90	438.6	25.64	24.94	14.4	0.96	2.75	97.35	1.14	\$4 36	840

JERSEY BUTTER RECORD — MONTHLY AVERAGES OF BARBARA ALLEN — FIRST PERIOD OF LACTATION.

Month of lactation.	DATE.	FROM 100 LBS OF MILK.			Pounds of milk required to make one pound of butter.	MONTHLY YIELD OF MILK, ETC.				DAILY YIELD.		Per cent. of fat in milk lost.	Per cent. of fat in milk recovered in butter.	Pounds of butter made for one pound of fat in milk.	Cost of food eaten.	Weight of animal.
		Pounds of fat in milk.	Pounds of fat in butter.	Pounds of butter containing 55 per cent. of butter fat.		Pounds of milk.	Pounds of fat in milk.	Pounds of fat in butter.	Pounds of butter.	Pounds of milk.	Pounds of butter.					
1.....	1890. September.....	4.92	4.76	5.60	17.86	519.0	25.53	24.70	29.06	17.3	0.97	8.25	96.75	1.14	\$3.81	763
2.....	October.....	5.16	5.00	5.88	17.01	501.7	25.89	25.09	29.51	16.3	0.95	8.10	96.90	1.14	4.46	779
3.....	November.....	5.33	5.17	6.03	16.45	494.2	26.34	25.55	30.06	16.5	1.00	8.00	97.00	1.14	5.04	779
4.....	December.....	5.55	5.39	6.34	15.77	450.6	25.00	24.28	28.57	14.5	0.92	8.88	97.12	1.14	4.74	770
5.....	1891. January.....	5.70	5.54	6.52	15.34	495.2	28.32	27.41	31.29	16.0	1.04	8.81	97.19	1.14	4.80	782
6.....	February.....	5.48	5.32	6.26	15.97	409.9	22.46	21.81	26.66	14.6	0.92	8.92	97.08	1.14	4.30	779
7.....	March.....	5.39	5.23	6.15	16.27	437.4	23.57	22.87	26.91	14.1	0.87	8.97	97.03	1.14	4.76	792
8.....	April.....	5.46	5.30	6.28	16.06	418.1	22.82	22.15	26.07	13.9	0.87	8.93	97.07	1.14	4.85	812
9.....	May.....	5.34	5.18	6.09	16.42	421.7	22.51	21.84	25.69	13.6	0.83	8.00	97.00	1.14	4.20	805
10.....	June.....	4.90	4.74	5.18	17.02	468.3	22.95	22.20	26.12	15.6	0.87	8.27	96.73	1.14	4.18	825
		5.31	5.15	6.06	16.50	461.6	24.53	23.79	28.00	15.2	0.92	8.00	97.00	1.14	\$4.41	799

## JERSEY BUTTER RECORD — MONTHLY AVERAGES OF BARBARA ALLEN — SECOND PERIOD OF LACTATION.

Month of lactation.	DATE.	FROM 100 LBS OF MILK.			MONTHLY YIELD OF MILK, ETC.				DAILY YIELD.		Per cent. of fat in milk lost.	Per cent. of fat in milk re-covered in butter.	Pounds of butter made for one pound of fat in milk.	Cost of food eaten.	Weight of animal.
		Pounds of fat in milk	Pounds of fat in butter.	Pounds of butter containing 85 per cent. of butter fat.	Pounds of milk.	Pounds of fat in milk.	Pounds of fat in butter.	Pounds of butter.	Pounds of milk.	Pounds of butter.					
1.....	1892.	4.65	4.49	5.38	18.94	560.0	36.04	35.14	39.58	13.7	0.99	96.56	1.14	\$3.33	891
2.....	April .....	4.81	4.65	5.47	13.98	680.8	33.74	31.66	37.25	32.0	1.30	96.67	1.14	4.36	902
3.....	May.....	4.33	4.07	4.79	30.88	648.0	37.41	36.37	31.04	31.6	1.08	96.33	1.13	5.11	884
4.....	June .....	4.43	4.33	5.08	19.63	633.8	33.39	37.88	32.30	30.4	1.04	96.43	1.13	4.97	878
5.....	July .....	4.58	4.43	5.30	19.33	543.4	34.84	33.97	33.30	17.5	0.91	96.51	1.14	4.83	848
6.....	August .....	4.80	4.64	5.46	18.31	462.7	33.21	31.47	35.36	15.4	0.84	96.67	1.14	4.47	861
7.....	September.....	5.13	4.97	5.85	17.09	480.6	34.65	33.83	33.11	15.5	0.91	96.86	1.14	5.53	911
8.....	October.....	5.56	5.40	6.35	15.75	485.3	31.30	33.50	27.65	14.5	0.88	97.12	1.14	5.53	893
9.....	November.....	6.02	5.86	6.89	14.53	374.9	32.57	31.97	35.64	13.1	0.83	97.34	1.14	5.44	901
10.....	December .....	6.66	6.50	7.65	13.07	356.7	33.76	33.19	27.29	11.5	0.83	97.60	1.15	4.75	991
	1893.	4.93	4.80	5.65	17.70	517.5	35.68	34.84	29.23	16.9	0.96	98.13	1.14	\$4.93	900
	January .....														

## JERSEY BUTTER RECORD — MONTHLY AVERAGES OF BARBARA ALLEN — THIRD PERIOD OF LACTATION.

Month of lactation.	DATE.	FROM 100 LBS. OF MILK.			Pounds of milk required to make one pound of butter.	MONTHLY YIELD OF MILK, ETC.				DAILY YIELD.		Per cent. of fat in milk lost.	Per cent. of fat in milk recovered in butter.	Pounds of butter made for one pound of fat in milk.	Cost of food eaten.	Weight of animal.
		Pounds of fat in milk.	Pounds of fat in butter.	Pounds of butter containing 86 per cent of butter fat.		Pounds of milk.	Pounds of fat in milk.	Pounds of fat in butter.	Pounds of butter.	Pounds of milk.	Pounds of butter.					
1.....	1893.															
2.....	May .....	4.15	3.99	4.69	21.33	731.6	30.36	39.19	34.33	23.6	1.11	3.86	96.14	1.13	\$3 47	875
3.....	June .....	4.90	4.74	5.58	17.93	704.2	38.91	37.64	44.30	26.5	1.43	3.37	96.73	1.14	4 99	881
4.....	July .....	5.38	5.13	6.03	16.91	763.2	40.94	39.02	45.90	34.6	1.43	3.03	96.97	1.14	5 06	883
5.....	August .....	4.90	4.74	5.58	17.93	667.6	32.71	31.64	37.34	21.5	1.30	3.36	96.74	1.14	5 64	901
6.....	September .....	4.90	4.74	5.58	17.93	738.9	36.73	34.55	40.66	34.3	1.36	3.36	96.74	1.14	5 45	914
7.....	October .....	6 00	5.84	6.87	14.56	634.5	37.47	36.46	43.91	30.1	1.33	2.67	97.33	1.14	5 11	874
8.....	November .....	6.45	6.39	7.40	13.51	572.2	36.91	35.99	43.34	19.1	1.41	2.43	97.52	1.15	5 38	933
9.....	December .....	6.10	5.94	6.99	14.31	537.5	35.84	34.90	41.06	19.0	1.33	2.63	97.33	1.15	5 96	1011
10.....	1894.															
1.....	January .....	6.10	5.94	6.99	14.31	541.1	33.00	33.14	37.61	17.5	1.32	2.63	97.33	1.15	5 45	1033
2.....	February .....	6.40	6.24	7.34	13.03	406.4	33.01	32.36	39.64	14.5	1.06	2.50	97.50	1.15	3 90	1019
3.....	March .....	5.41	5.35	6.13	16.18	641.6	34.73	33.63	39.65	21.1	1.30	2.66	97.66	1.14	\$5 02	933

## JERSEY BUTTER RECORD — MONTHLY AVERAGES OF COUNTESS FLAVIA — FIRST PERIOD OF LACTATION.

Month of lactation.	DATE.	FROM 100 LBS OF MILK.				MONTHLY YIELD OF MILK, ETC.				DAILY YIELD.		Per cent. of fat in milk lost.	Per cent. of fat in milk recovered in butter.	Pounds of butter made for one pound of fat in milk	Cost of food eaten.	Weight of animal.
		Pounds of fat in milk.	Pounds of fat in butter.	Pounds of butter containing 85 per cent. of butter fat.	Pounds of milk required to make one pound of butter.	Pounds of milk.	Pounds of fat in milk.	Pounds of fat in butter.	Pounds of butter.	Pounds of milk.	Pounds of butter.					
1.....	1890. April.....	6.11	5.95	7.00	14.59	430.7	35.70	35.03	39.45	14.0	0.96	2.63	97.38	1.15	\$4.09	695
2.....	May.....	4.84	4.65	5.51	18.15	637.7	30.35	33.38	34.57	30.3	1.13	3.31	96.69	1.14	4.49	696
3.....	June.....	5.33	5.16	6.07	16.47	614.5	33.69	31.71	37.30	30.4	1.34	3.01	96.99	1.14	6.33	693
4.....	July.....	5.35	5.20	6.11	16.37	590.5	31.11	30.18	35.49	18.7	1.14	2.99	97.01	1.14	4.61	673
5.....	August.....	5.37	5.21	6.13	16.31	574.0	30.53	39.10	35.19	18.5	1.14	2.98	97.03	1.14	5.19	700
6 ..	September.....	6.13	5.96	7.01	14.37	492.4	30.13	39.34	34.53	16.4	1.15	2.61	97.39	1.15	4.93	734
7.....	October.....	6.00	5.84	6.87	14.56	474.1	28.44	27.63	32.57	15.3	1.05	2.67	97.33	1.15	4.77	712
8.....	November.....	6.41	6.25	7.35	13.60	443.7	36.38	27.67	33.55	14.8	1.09	2.50	97.50	1.15	5.38	714
9 .....	December.....	6.19	6.03	7.09	14.10	445.9	37.78	27.05	31.88	14.5	1.03	2.58	97.42	1.15	5.05	736
10.....	1891. January.....	6.45	6.29	7.40	13.51	449.8	39.01	26.39	33.38	14.5	1.07	2.46	97.53	1.15	5.32	750
		5.75	5.59	6.56	15.21	512.5	39.44	26.65	33.70	16.7	1.10	2.78	97.33	1.15	\$5.00	709

## JERSEY BUTTER RECORD—MONTHLY AVERAGES OF COUNTESS FLAVIA—SECOND PERIOD OF LACTATION.

Month of lactation.	DATE.	FROM 100 LBS. OF MILK			MONTHLY YIELD OF MILK, ETC.				DAILY YIELD.		Per cent. of fat in milk lost.	Per cent. of fat in milk recovered in butter.	Pounds of butter made for one pound of fat in milk.	Cost of food eaten.	Weight of animal.
		Pounds of fat in milk.	Pounds of fat in butter.	Pounds of butter containing 86 per cent. of butter fat.	Pounds of milk required to make one pound of butter.	Pounds of milk.	Pounds of fat in milk.	Pounds of butter.	Pounds of milk.	Pounds of butter.					
1.....	1891. November.....	5.69	5.53	6.51	15.36	404.5	23.02	23.37	26.33	13.5	0.83	97.19	1.14	\$3.00	794
2.....	December.....	5.53	5.36	6.31	15.86	730.8	39.79	38.64	45.47	23.2	1.47	97.10	1.14	4.17	803
3.....	1892. January.....	6.17	6.01	7.07	14.14	636.8	38.67	37.67	44.33	20.3	1.43	97.41	1.15	5.25	809
4.....	February.....	5.96	5.79	6.81	14.68	506.7	30.14	29.34	34.51	17.5	1.19	97.31	1.14	4.46	811
5.....	March.....	6.25	6.09	7.6	13.97	504.1	31.50	30.69	36.10	16.3	1.16	97.44	1.15	4.63	820
6.....	April.....	6.33	6.16	7.25	13.79	491.1	31.04	30.25	35.60	16.4	1.19	97.47	1.15	4.60	836
7.....	May.....	6.05	5.89	6.93	14.43	506.7	30.65	29.84	35.11	16.3	1.13	97.36	1.15	4.86	847
8.....	June.....	5.05	4.89	5.75	17.39	453.9	22.92	22.30	26.11	15.1	0.87	96.63	1.14	4.53	835
9.....	July.....	4.84	4.68	5.51	18.15	453.2	21.98	21.30	24.96	14.6	0.81	96.69	1.14	4.57	853
10.....	August.....	6.43	6.27	7.36	13.54	349.8	22.49	21.93	25.81	11.3	0.83	97.51	1.15	3.64	870
		5.83	5.66	6.66	15.00	501.8	29.23	28.40	33.41	16.5	1.10	97.25	1.14	\$4.51	885

## JERSEY BUTTER RECORD — MONTHLY AVERAGES OF COUNTESS FLAVIA — THIRD PERIOD OF LACTATION.

Month of lactation.	DATE.	FROM 100 LBS. OF MILK.			Pounds of milk required to make one pound of butter.	MONTHLY YIELD OF MILK, ETC.				DAILY YIELD.		Per cent. of fat in milk lost.	Per cent. of fat in milk recovered in butter.	Pounds of butter made for one pound of fat in milk.	Cost of food eaten.	Weight of animal.
		Pounds of fat in milk.	Pounds of fat in butter.	Pounds of butter containing 85 per cent. of butter fat.		Pounds of milk.	Pounds of fat in milk.	Pounds of fat in butter.	Pounds of butter.	Pounds of milk.	Pounds of butter.					
1.....	1892. November.....	5.90	5.74	6.76	14.79	515.0	30.39	29.56	34.78	18.5	1.16	2.70	97.30	1.15	\$3.40	773
2.....	December.....	5.91	5.76	6.77	14.77	639.7	37.31	36.31	42.63	20.3	1.37	2.71	97.29	1.15	5.57	801
3.....	1893. January.....	6.37	6.31	7.81	13.63	560.5	35.70	34.81	40.96	18.1	1.31	2.51	97.49	1.15	5.14	837
4.....	February.....	6.25	6.09	7.16	13.97	477.1	29.83	30.06	34.17	17.0	1.22	2.56	97.44	1.16	5.16	839
5.....	March.....	6.05	5.89	6.93	14.43	531.4	31.54	30.71	36.13	16.8	1.17	2.64	97.36	1.15	5.33	837
6.....	April.....	6.30	6.04	7.11	14.06	498.4	30.77	29.98	35.18	16.5	1.13	2.58	97.42	1.15	5.06	873
7.....	MAY.....	6.23	6.16	7.26	13.79	479.8	30.33	29.55	34.78	15.5	1.13	2.53	97.47	1.15	4.61	835
8.....	June.....	6.05	5.89	6.93	14.43	398.6	23.99	23.36	27.46	15.3	0.92	2.64	97.36	1.15	3.83	893
9.....	July.....	6.03	5.92	6.96	14.37	363.2	23.03	21.50	25.39	11.7	0.83	2.63	97.37	1.15	2.76	833
10.....	August.....	5.45	5.29	6.32	16.08	243.6	13.55	13.15	15.47	8.0	0.50	2.94	97.06	1.14	3.02	896
		6.09	5.93	6.96	14.33	463.8	23.54	27.80	33.70	15.4	1.06	2.63	97.33	1.15	\$4.39	820

## JERSEY BUTTER RECORD — MONTHLY AVERAGES OF COUNTESS FLAVIA — FOURTH PERIOD OF LACTATION.

Month of lactation.	DATE.	FROM 100 LBS. OF MILK.			MONTHLY YIELD OF MILK, ETC.				DAILY YIELD.		Per cent. of fat in milk lost.	Per cent of fat in milk recovered in butter.	Pounds of butter made for one pound of fat in milk.	Cost of food eaten.	Weight of animal.
		Pounds of fat in milk.	Pounds of fat in butter.	Pounds of butter containing 86 per cent. of butter fat.	Pounds of milk.	Pounds of fat in milk.	Pounds of fat in butter.	Pounds of butter.	Pounds of milk.	Pounds of butter.					
1.....	1893. November.....	5.37	5.21	6.12	570.0	30.61	29.70	35.00	19.0	1.17	2.98	97.02	1.14	\$3.63	188
2.....	December.....	6.01	5.85	6.88	731.8	43.93	42.81	50.37	23.6	1.63	2.66	97.34	1.15	5.14	827
3.....	1894. January.....	6.31	6.15	7.24	698.9	44.10	42.98	50.57	22.5	1.63	2.54	97.46	1.15	5.28	813
4.....	February.....	6.10	5.94	6.99	635.6	38.16	37.16	43.72	22.3	1.56	2.62	97.38	1.15	4.94	857
5.....	March.....	6.35	6.09	7.16	693.6	43.35	42.24	49.70	22.4	1.60	2.56	97.44	1.15	5.78	890
6.....	April.....	6.00	5.84	6.87	595.2	35.71	34.76	40.90	19.8	1.36	2.67	97.33	1.15	4.60	888
7.....	May.....	6.72	6.56	7.72	572.5	38.47	37.56	44.18	18.5	1.43	2.38	97.63	1.15	4.90	855
8.....	June.....	6.47	6.31	7.42	433.5	28.05	27.35	33.18	14.4	1.07	2.47	97.53	1.15	3.90	774
9.....	July.....	5.77	5.61	6.80	413.0	23.33	23.17	27.25	13.3	0.88	2.77	97.23	1.14	3.40	861
10.....	August.....	5.65	5.49	6.46	381.3	21.54	20.28	24.63	12.3	0.79	2.83	97.17	1.14	3.50	871
		6.00	5.98	6.93	571.5	34.73	33.80	39.87	12.8	1.31	2.60	97.40	1.15	\$4.51	839

## JERSEY BUTTER RECORD — MONTHLY AVERAGES OF GILDEEBLOOM — FIRST PERIOD OF LACTATION.

Month of lactation.	DATE.	FROM 100 LBS. OF MILK.				Pounds of milk required to make one pound of butter.	MONTHLY YIELD OF MILK, ETC.				DAILY YIELD.		Per cent. of fat in milk lost.	Per cent. of fat in milk recovered in butter.	Pounds of butter made for one pound of fat in milk.	Cost of food eaten.	Weight of animal.
		Pounds of fat in milk.	Pounds of butter.	Pounds of butter containing 86 per cent of butter fat.	Pounds of milk.		Pounds of milk.	Pounds of fat in milk.	Pounds of butter.	Pounds of milk.							
1.....	1890.																
2.....	September.....	6.10	5.94	6.99	14.31	486.0	29.64	28.86	33.97	16.2	1.13	2.62	97.38	1.15	\$3 12	770	
3.....	October.....	5.63	5.46	6.42	15.58	535.6	30.10	29.25	31.41	17.3	1.11	2.85	97.15	1.14	4 53	784	
4.....	November.....	5.19	5.03	5.92	16.89	473.8	24.59	23.83	28.05	15.8	0.94	3.08	96.92	1.14	4 84	744	
5.....	December.....	6.16	6.00	7.06	14.16	410.7	25.30	24.64	28.99	13.2	0.94	2.60	97.40	1.15	4 49	786	
6.....	1891.																
7.....	January.....	5.47	5.31	6.24	16.02	428.4	23.43	22.75	26.75	13.8	0.86	2.93	97.07	1.14	4 13	763	
8.....	February.....	5.37	5.21	6.13	16.31	343.3	18.44	17.89	21.04	12.3	0.75	2.98	97.02	1.14	4 55	766	
9.....	March ..	5.68	5.52	6.49	15.41	312.0	19.43	18.83	22.20	11.0	0.72	2.82	97.18	1.14	4 47	751	
10.....	April.....	5.61	5.45	6.41	15.60	307.1	17.23	16.74	19.69	10.3	0.65	2.85	97.15	1.14	3 64	786	
11.....	May.....	5.63	5.47	6.44	15.53	356.8	20.09	19.52	22.97	11.5	0.74	2.84	97.16	1.14	3 83	787	
12.....	June.....	5.65	5.49	6.46	15.50	315.5	17.88	17.33	20.38	10.5	0.68	2.83	97.17	1.14	3 63	831	
13.....		5.66	5.49	6.46	15.50	400.0	22.61	21.96	25.84	18.2	0.85	2.83	97.17	1.14	\$4 17	769	

JERSEY BUTTER RECORD — MONTHLY AVERAGES OF GILDEEBLOOM — THIRD PERIOD OF LACTATION.

Month of lactation.	DATE.	FROM 100 LBS. OF MILK.			MONTHLY YIELD OF MILK, ETC.				DAILY YIELD.		Per cent. of fat in milk lost.	Per cent. of fat in milk recovered in butter.	Pounds of butter made in for one pound of fat in milk.	Cost of food eaten.	Weight of animal.
		Pounds of fat in milk.	Pounds of fat in butter.	Pounds of butter containing 86 per cent. of butter fat.	Pounds of milk required to make one pound of butter.	Pounds of milk.	Pounds of fat in milk.	Pounds of fat in butter.	Pounds of milk.	Pounds of butter.					
1.....	1888. April.....	5.55	5.39	6.34	15.77	567.0	31.46	30.56	35.95	18.9	1.30	2.88	97.12	1.14	867
2.....	May.....	4.56	4.40	5.19	19.30	732.0	33.93	31.77	37.39	23.3	1.21	3.51	97.49	1.14	847
3.....	June.....	5.38	5.22	6.14	16.39	630.7	33.33	32.92	38.73	21.0	1.29	2.97	97.03	1.14	850
4.....	July.....	5.32	5.06	5.95	16.81	638.1	33.79	31.78	37.33	20.6	1.21	3.07	96.93	1.14	858
5.....	August.....	5.75	5.59	6.53	15.30	609.3	35.03	34.06	40.08	19.7	1.29	2.78	97.32	1.14	835
6.....	September.....	5.30	5.14	6.05	16.53	611.7	33.43	31.44	37.00	20.4	1.23	3.02	96.98	1.14	839
7.....	October.....	5.45	5.29	6.22	16.08	537.0	32.27	28.41	33.41	17.3	1.06	2.94	97.06	1.14	839
8.....	November.....	5.95	5.79	6.81	14.68	467.4	27.81	27.06	31.84	15.6	1.06	2.69	97.31	1.14	881
9.....	December.....	5.70	5.54	6.53	15.34	495.3	28.23	27.44	32.29	16.0	1.04	2.81	97.19	1.14	919
10.....	1891. January.....	6.38	6.22	7.32	13.66	375.5	22.96	23.35	27.46	12.1	0.89	2.51	97.49	1.15	900
		5.45	5.29	6.22	16.03	564.4	30.78	29.86	35.12	18.5	1.15	2.94	97.06	1.14	864

## SHORTHORN BUTTER RECORD—MONTHLY AVERAGES OF BETSEY 10TH—FIRST PERIOD OF LACTATION.

Month of lactation.	DATE.	FROM 100 LBS. OF MILK.			Pounds of milk required to make one pound of butter.	MONTHLY YIELD OF MILK, ETC.				DAILY YIELD.		Per cent. of fat in milk lost.	Per cent. of fat in milk recovered in butter.	Pounds of butter made for one pound of fat in milk.	Cost of food eaten.	Weight of animal.
		Pounds of fat in	Pounds of butter.	Pounds of butter containing 83 per cent of butter fat.		Pounds of milk.	Pounds of fat in milk.	Pounds of butter.	Pounds of milk.	Pounds of butter.	Pounds of milk.					
1.....	1892.	4.56	4.40	5.13	19.30	626.2	29.55	27.55	32.43	20.2	1.04	3.51	96.49	1.14	\$2 96	1020
2.....	May .....	4.02	3.86	4.54	22.03	657.1	27.62	26.32	31.20	22.9	1.04	3.98	96.02	1.13	3 83	976
3.....	June .....	3.92	3.76	4.42	22.62	650.6	26.50	24.46	28.77	21.0	0.93	4.08	95.92	1.13	3 46	935
4.....	July .....	3.68	3.72	4.38	22.83	531.6	20.63	19.78	23.97	17.2	0.75	4.12	95.88	1.13	3 68	963
5.....	August .....	3.95	3.79	4.45	22.42	425.5	16.81	16.13	18.98	14.2	0.83	4.05	95.95	1.13	2 83	883
6.....	September .....	4.15	3.99	4.69	21.33	433.7	18.00	17.31	20.35	14.0	0.66	3.85	96.14	1.13	4 00	889
7.....	October .....	4.45	4.29	5.05	19.80	437.8	19.46	18.78	22.10	14.6	0.74	3.60	96.40	1.13	5 73	901
8.....	November .....	4.42	4.26	5.01	19.96	445.2	19.63	18.97	22.31	14.4	0.72	3.62	96.38	1.13	6 96	922
9.....	December .....	5.02	4.86	5.72	17.48	411.8	20.67	20.01	23.55	13.3	0.76	3.19	96.81	1.14	5 83	1044
10.....	1893.	4.80	4.64	5.46	18.31	369.4	17.73	17.14	20.17	13.2	0.72	3.33	96.67	1.14	5 82	1081
	January .....	4.98	4.12	4 85	20.62	501.9	21.47	20.68	21.33	16.5	0.80	3.74	96.26	1.13	\$4 40	948
	February .....															

SHORTHORN BUTTER RECORD—MONTHLY AVERAGES OF BETSEY 10TH—SECOND PERIOD OF LACTATION.

Month of lactation.	DATE.	FROM 100 LBS OF MILK			MONTHLY YIELD OF MILK, ETC.				DAILY YIELD.		Per cent. of fat in milk lost.	Per cent. of fat in milk recovered in butter.	Pounds of butter made in one pound of fat in milk.	Cost of food eaten.	Weight of animal.
		Pounds of fat in milk.	Pounds of fat in butter.	Pounds of butter containing 85 per cent. of butter fat.	Pounds of milk to make one pound of butter.	Pounds of milk.	Pounds of fat in milk.	Pounds of butter.	Pounds of milk.	Pounds of butter.					
1.....	1893. December .....	4.49	4.33	5.02	19.35	896.6	33.81	38.39	45.16	28.6	1.43	4.56	96.44	1.13	1087
2.....	1894 January .....	4.62	4.46	5.36	19.05	941.1	43.49	41.97	49.41	30.4	1.60	3.46	96.54	1.13	1077
3.....	February .....	4.52	4.36	5.16	19.49	782.9	35.39	34.13	40.40	27.9	1.43	3.54	96.46	1.13	1110
4.....	March.....	4.62	4.46	5.36	19.05	896.6	33.19	31.87	43.40	26.7	1.40	3.47	96.53	1.13	1106
5.....	April .....	4.72	4.56	5.36	18.96	693.0	32.71	31.60	37.14	23.1	1.34	3.39	16.61	1.14	1117
6.....	May .....	4.76	4.59	5.40	18.92	652.2	30.98	29.94	35.32	21.0	1.13	3.37	96.63	1.14	1063
7.....	June.....	4.46	4.39	5.06	19.80	594.2	26.00	25.06	29.51	19.5	0.98	3.60	96.40	1.13	1102
8.....	July.....	4.50	4.34	5.11	19.57	597.9	26.91	26.93	30.55	19.3	0.99	3.56	96.44	1.13	1094
9.....	August.....	4.55	4.39	5.16	19.38	596.6	27.15	26.19	30.78	19.2	0.99	3.52	96.43	1.13	1099
0.....	September.....	4.27	4.11	4.83	20.70	530.0	21.63	21.76	25.63	17.7	0.85	3.75	96.25	1.13	1132
		4.56	4.40	5.18	19.30	709.1	23.33	31.30	36.70	23.3	1.21	3.50	96.50	1.13	1096
														\$3.85	

## HOLSTEIN-FRIESIAN BUTTER RECORD — MONTHLY AVERAGES OF RUTH — FIRST PERIOD OF LACTATION.

Month of lactation.	DATE.	FROM 100 LBS. OF MILK.			Pounds of milk required to make one pound of butter.	MONTHLY YIELD OF MILK, ETC.				DAILY YIELD.		Per cent. of fat in milk lost.	Per cent. of fat in milk recovered in butter.	Pounds of butter made for one pound of fat in milk.	Cost of food eaten.	Weight of animal.
		Pounds of fat in	Pounds of fat in	Pounds of butter containing 95 per cent of butter fat.		Pounds of milk.	Pounds of fat in	Pounds of butter.	Pounds of milk.	Pounds of milk.	Pounds of butter.					
1.....	1893. December.....	2.83	2.66	3.13	31.93	877.3	24.74	23.34	27.45	28.3	0.89	5.87	94.33	1.11	\$3.89	1084
2.....	1894. January.....	2.79	2.63	3.09	29.26	941.4	26.27	24.76	29.13	30.4	0.94	5.73	94.27	1.11	5.46	1080
3.....	February.....	2.66	2.52	2.96	23.78	793.9	21.23	20.06	23.00	28.4	0.84	5.26	94.08	1.11	5.10	1132
4.....	March.....	2.90	2.74	3.22	31.06	849.0	24.63	23.26	27.26	27.4	0.88	5.53	94.48	1.11	5.94	1140
5.....	April.....	2.95	2.79	3.26	30.49	689.5	20.84	19.24	22.64	28.0	0.75	5.42	94.58	1.11	4.63	1164
6.....	May.....	3.05	2.89	3.40	29.41	633.2	19.31	18.30	21.53	20.4	0.69	5.25	94.75	1.12	4.16	1120
7.....	June.....	2.90	2.74	3.22	31.06	538.4	15.61	14.75	17.35	17.9	0.53	5.52	94.48	1.11	3.71	1180
8.....	July.....	2.92	2.76	3.26	30.77	430.4	12.57	11.86	14.00	13.9	0.45	5.43	94.53	1.11	3.94	1208
9.....	August.....	2.95	2.79	3.26	30.49	356.2	10.51	9.94	11.70	11.5	0.38	5.62	91.58	1.11	4.19	1217
10.....	September.....	3.25	3.09	3.64	27.47	226.6	7.26	7.00	8.26	7.5	0.27	4.29	95.08	1.12	2.28	1237
		2.83	2.73	3.20	31.25	633.8	18.27	17.94	20.28	20.8	0.67	5.50	94.50	1.11	\$4.22	1154

## JERSEY BUTTER RECORD — MONTHLY AVERAGES OF ALBERT'S CAROL — FIRST PERIOD OF LACTATION.

Month of lactation.	DATE.	FROM 100 LBS. OF MILK.				MONTHLY YIELD OF MILK, ETC.				DAILY YIELD.		Per cent. of fat in milk lost.	Per cent. of fat in milk recovered in butter.	Pounds of butter made for one pound of fat in milk.	Cost of food eaten.	Weight of animal.
		Pounds of fat in milk.	Pounds of butter.	Pounds of fat in butter containing 85 per cent. of butter fat.	Pounds of milk required to make one pound of butter.	Pounds of milk.	Pounds of fat in milk.	Pounds of butter.	Pounds of fat in butter.	Pounds of milk.	Pounds of butter.					
1.....	1892.															
1.....	May .....	3.99	3.83	4.50	22.17	603.6	24.08	23.13	27.18	19.5	0.83	4.01	96.99	1.13	\$4.21	641
2.....	June .....	4.57	4.41	5.19	19.37	553.6	25.30	24.41	28.73	18.5	0.96	3.50	96.50	1.14	5.04	615
3.....	July .....	4.28	4.13	4.84	20.66	554.0	23.71	22.89	26.83	17.9	0.87	3.74	96.36	1.13	4.38	633
4.....	August.....	4.64	4.48	5.27	18.98	469.7	21.79	21.04	24.75	15.2	0.80	3.45	96.55	1.14	4.15	648
5.....	September.....	4.60	4.44	5.22	19.16	433.6	19.95	19.35	22.64	14.5	0.75	3.48	96.53	1.13	4.14	639
6.....	October .....	5.13	4.97	5.55	17.09	436.5	22.49	21.79	23.65	14.1	0.83	3.12	96.98	1.14	5.00	688
7.....	November .....	5.78	5.62	6.01	15.13	433.2	24.93	24.39	23.57	14.4	0.96	2.77	97.23	1.14	5.34	690
8.....	December .....	6.35	6.19	7.28	13.75	434.6	27.60	26.90	31.65	14.0	1.02	2.52	97.46	1.15	5.07	733
9.....	1893.															
9.....	January .....	6.50	6.34	7.46	13.40	439.9	27.94	27.35	33.07	13.9	1.03	2.46	97.54	1.15	4.63	755
10.....	February .....	7.05	6.89	8.11	12.33	374.4	26.40	25.80	30.36	13.4	1.08	2.27	97.73	1.15	4.38	769
		5.17	5.01	5.89	17.00	473.4	24.43	23.67	27.85	15.5	0.93	3.10	96.90	1.14	\$4.63	680

## JERSEY BUTTER RECORD—MONTHLY AVERAGES OF ALBERT'S CAROL—SECOND PERIOD OF LACTATION.

Month of lactation.	DATE.	FROM 100 LBS. OF MILK.			Pounds of milk required to make one pound of butter.	MONTHLY YIELD OF MILK, ETC.				DAILY YIELD.		Per cent. of fat in milk lost.	Per cent. of fat in milk recovered in butter.	Pounds of butter made for one pound of fat in milk.	Cost of food eaten.	Weight of animal.
		Pounds of fat in milk.	Pounds of fat in butter.	Pounds of butter containing 86 per cent. of butter fat.		Pounds of milk.	Pounds of fat in milk.	Pounds of butter.	Pounds of fat in butter.	Pounds of milk.	Pounds of butter.					
1.....	1893. November .....	5.17	5.01	5.99	16.98	492.3	21.83	31.16	34.38	14.1	0.83	3.09	96.91	1.14	\$3 18	764
2.....	December .....	6.12	5.96	7.01	14.27	538.1	33.93	32.07	37.73	17.4	1.32	2.93	97.38	1.15	4 47	797
3.....	1894. January .....	5.97	5.81	6.84	14.62	565.0	33.73	33.83	38.03	18.2	1.24	2.86	97.32	1.15	4 96	800
4.....	February .....	6.07	5.91	6.95	14.19	505.7	30.70	29.89	35.16	18.0	1.35	2.64	97.36	1.15	4 61	846
5.....	March .....	6.17	6.01	7.07	14.14	538.4	33.32	32.36	38.07	17.4	1.23	2.59	97.41	1.15	5 17	844
6.....	April .....	6.15	5.99	7.05	14.18	468.1	28.79	28.05	33.00	15.6	1.10	2.80	97.40	1.15	4 65	876
7.....	May .....	5.75	5.59	6.58	15.19	478.3	27.50	26.74	31.46	15.4	1.01	2.78	97.32	1.14	4 67	867
8.....	June .....	5.35	5.19	6.10	16.39	369.5	19.77	19.18	22.55	12.3	0.75	2.99	97.01	1.14	3 83	854
9.....	July .....	5.82	5.66	6.66	15.01	315.7	18.27	17.87	21.03	10.1	0.67	2.76	97.25	1.14	3 56	871
10.....	August .....	5.17	5.01	5.89	16.98	184.8	9.55	9.26	10.90	5.9	0.26	3.10	96.90	1.14	3 53	895
		5.85	5.69	6.70	14.90	488.6	25.64	24.94	29.30	14.4	0.96	2.75	97.25	1.14	\$4.36	840

JERSEY BUTTER RECORD — MONTHLY AVERAGES OF BARBARA ALLEN — FIRST PERIOD OF LACTATION.

Month of lactation.	DATE.	FROM 100 LBS OF MILK.			Pounds of milk required to make one pound of butter.	MONTHLY YIELD OF MILK, ETC.				DAILY YIELD.		Per cent. of fat in milk lost.	Per cent. of fat in milk recovered in butter.	Pounds of butter made from one pound of fat in milk.	Cost of food eaten.	Weight of animal.
		Pounds of fat in milk.	Pounds of fat in butter.	Pounds of butter containing 86 per cent of butter fat.		Pounds of milk.	Pounds of fat in milk.	Pounds of fat in butter.	Pounds of butter.	Pounds of milk.	Pounds of butter.					
1.....	1890. September.....	4.92	4.76	5.60	17.86	519.0	25.53	24.70	29.06	17.8	0.97	8.95	96.75	1.14	\$3.81	763
2.....	October.....	5.16	5.00	5.88	17.01	501.7	25.89	25.09	29.51	16.3	0.95	8.10	96.90	1.14	4.45	779
3.....	November.....	5.38	5.17	6.08	16.45	494.2	26.34	25.55	30.06	16.5	1.00	8.00	97.00	1.14	5.04	779
4.....	December.....	5.55	5.39	6.34	15.77	450.6	25.00	24.28	28.57	14.5	0.92	9.88	97.13	1.14	4.74	770
5.....	1891. January.....	5.70	5.54	6.52	15.34	495.2	28.22	27.41	31.29	16.0	1.04	9.81	97.19	1.14	4.80	782
6.....	February.....	5.48	5.33	6.36	15.97	499.9	22.46	21.81	25.66	14.6	0.93	9.93	97.06	1.14	4.30	770
7.....	March.....	5.39	5.23	6.15	16.27	437.4	23.57	22.87	26.91	14.1	0.87	9.97	97.03	1.14	4.76	792
8.....	April.....	5.46	5.30	6.28	16.06	418.1	22.82	22.15	26.07	13.9	0.87	9.93	97.07	1.14	4.35	812
9.....	May.....	5.34	5.18	6.09	16.42	421.7	22.51	21.84	25.69	13.6	0.83	8.00	97.00	1.14	4.20	805
10.....	June.....	4.90	4.74	5.58	17.92	468.3	22.95	22.20	26.13	15.6	0.87	8.27	96.73	1.14	4.18	825
		5.31	5.15	6.06	16.50	461.6	24.53	23.79	28.00	15.2	0.92	8.00	97.00	1.14	\$4.41	769

## JERSEY BUTTER RECORD — MONTHLY AVERAGES OF BARBARA ALLEN — SECOND PERIOD OF LACTATION.

Month of lactation.	DATE.	FROM 100 LBS OF MILK.			MONTHLY YIELD OF MILK, ETC.				DAILY YIELD.		Per cent. of fat in milk lost.	Per cent. of fat in milk recovered in butter.	Pounds of butter made for one pound of fat in milk.	Cost of food eaten.	Weight of animal.
		Pounds of fat in milk.	Pounds of fat in butter.	Pounds of butter containing 85 per cent. of butter fat.	Pounds of milk.	Pounds of fat in milk.	Pounds of fat in butter.	Pounds of butter.	Pounds of milk.	Pounds of butter.					
1.....	1898. April .....	4.65	4.49	5.86	18.94	560.0	26.04	35.14	29.58	18.7	0.99	8.44	96.56	1.14	891
2.....	May .....	4.81	4.65	5.47	18.38	680.8	33.74	31.66	27.35	28.0	1.20	8.33	96.67	1.14	902
3.....	June .....	4.23	4.07	4.79	20.88	648.0	27.41	26.37	31.04	21.6	1.03	8.78	96.22	1.13	884
4.....	July .....	4.48	4.32	5.08	19.68	633.8	28.39	27.38	33.30	30.4	1.04	8.57	96.43	1.13	876
5.....	August .....	4.58	4.42	5.30	19.23	542.4	24.84	23.97	28.30	17.5	0.91	8.49	96.51	1.14	848
6.....	September .....	4.80	4.64	5.46	18.31	463.7	22.21	21.47	25.26	15.4	0.84	8.33	96.67	1.14	861
7.....	October .....	5.13	4.97	5.85	17.09	480.6	24.65	23.83	26.11	15.5	0.91	8.12	96.68	1.14	911
8.....	November .....	5.56	5.40	6.35	15.75	485.3	24.30	23.50	27.65	14.5	0.92	8.83	97.19	1.14	893
9.....	December .....	6.02	5.86	6.89	14.52	374.9	22.57	21.97	25.84	13.1	0.83	9.66	97.34	1.14	901
10.....	1893. January .....	6.65	6.50	7.65	13.07	356.7	23.76	23.19	27.29	11.5	0.88	9.40	97.60	1.15	991
		4.96	4.80	5.65	17.70	517.5	25.68	24.84	29.23	16.9	0.96	8.23	96.15	1.14	900

JERSEY BUTTER RECORD—MONTHLY AVERAGES OF BARBARA ALLEN—THIRD PERIOD OF LACTATION.

Month of lactation.	DATE.	FROM 100 LBS. OF MILK.				MONTHLY YIELD OF MILK, ETC.				DAILY YIELD.		Per cent. of fat in milk lost.	Per cent. of fat in milk recovered in butter.	Pounds of butter made for one pound of fat in milk.	Cost of food eaten.	Weight of animal.
		Pounds of fat in milk.	Pounds of fat in butter.	Pounds of butter containing 86 per cent of butter fat.	Pounds of milk required to make one pound of butter.	Pounds of milk.	Pounds of fat in milk.	Pounds of fat in butter.	Pounds of butter.	Pounds of milk.	Pounds of butter.					
1.....	1893.															
2.....	May .....	4.15	3.99	4.69	21.32	731.6	30.86	29.19	84.33	33.6	1.11	3.86	96.14	1.13	\$3.47	876
3.....	June .....	4.90	4.74	5.58	17.93	704.2	38.91	37.64	44.30	36.5	1.46	3.27	96.73	1.14	4.99	881
4.....	July .....	5.28	5.12	6.02	16.61	762.2	40.94	39.03	45.90	34.6	1.43	3.03	96.97	1.14	5.08	883
5.....	August .....	4.90	4.74	5.58	17.92	667.6	32.71	31.64	37.94	31.5	1.30	3.26	96.74	1.14	5.54	901
6.....	September .....	4.90	4.74	5.58	17.92	738.9	35.73	34.55	40.66	34.3	1.36	3.26	96.74	1.14	5.45	914
7.....	October .....	6.60	5.94	6.87	14.56	634.5	37.47	36.46	42.91	30.1	1.38	2.67	97.33	1.14	5.11	874
8.....	November .....	6.45	6.39	7.40	13.51	572.2	36.91	35.99	43.34	19.1	1.41	2.48	97.53	1.15	5.38	933
9.....	December .....	6.10	5.94	6.99	14.31	557.5	35.94	34.90	41.06	19.0	1.33	2.62	97.33	1.15	5.96	1011
10.....	1894.															
1.....	January .....	6.10	5.94	6.99	14.31	541.1	33.00	32.14	37.81	17.5	1.33	2.62	97.33	1.15	5.45	1033
2.....	February .....	6.40	6.24	7.34	13.63	406.4	26.01	25.36	39.84	14.5	1.06	2.50	97.50	1.15	3.80	1013
3.....		5.41	5.25	6.19	16.13	641.6	34.72	33.63	39.65	21.1	1.30	2.95	97.05	1.14	\$5.02	933

## JERSEY BUTTER RECORD — MONTHLY AVERAGES OF COUNTESS FLAVIA — FIRST PERIOD OF LACTATION.

Month of lactation.	DATE.	FROM 100 LBS OF MILK.			Pounds of milk required to make one pound of butter.	MONTHLY YIELD OF MILK, ETC.				DAILY YIELD.		Per cent. of fat in milk recovered in butter.	Pounds of butter made for one pound of fat in milk	Cost of food eaten.	Weight of animal.
		Pounds of fat in milk.	Pounds of fat in butter.	Pounds of butter containing 85 per cent. of butter fat.		Pounds of milk.	Pounds of fat in milk.	Pounds of fat in butter.	Pounds of butter.	Pounds of milk.	Pounds of butter.				
1.....	1890. April.....	6.11	5.95	7.00	14.29	430.7	26.70	25.03	29.45	14.0	0.95	97.38	1.15	\$4.09	695
2.....	May.....	4.84	4.63	5.51	18.15	637.7	30.33	29.38	34.57	30.3	1.13	96.69	1.14	4.49	696
3.....	June.....	5.32	5.16	6.07	16.47	614.5	29.69	31.71	37.30	30.4	1.24	96.99	1.14	6.26	693
4.....	July.....	5.36	5.20	6.11	16.37	530.5	31.11	30.18	35.49	18.7	1.14	97.01	1.14	4.61	673
5.....	August.....	5.37	5.21	6.13	16.31	574.0	30.53	29.10	35.19	18.5	1.14	97.02	1.14	5.19	700
6 .....	September.....	6.12	5.96	7.01	14.27	493.4	30.13	29.34	34.53	16.4	1.15	97.39	1.15	4.93	794
7.....	October.....	6.00	5.84	6.87	14.56	474.1	28.44	27.68	32.57	15.3	1.05	97.33	1.15	4.77	712
8.....	November.....	6.41	6.25	7.35	13.60	442.7	28.38	27.67	33.55	14.8	1.09	97.50	1.15	5.33	714
9.....	December.....	6.19	6.03	7.09	14.10	418.9	27.73	27.06	31.83	14.5	1.03	97.42	1.15	5.05	736
10.....	1891. January.....	6.45	6.29	7.40	13.51	449.8	29.01	28.29	33.28	14.5	1.07	97.53	1.15	5.23	750
		5.75	5.59	6.53	15.21	512.5	29.44	28.65	33.70	16.7	1.10	97.32	1.15	\$5.00	709

## JERSEY BUTTER RECORD — MONTHLY AVERAGES OF COUNTESS FLAVIA — SECOND PERIOD OF LACTATION.

Month of lactation.	DATE.	FROM 100 LBS. OF MILK				Pounds of milk required to make one pound of butter.	MONTHLY YIELD OF MILK, ETC.				DAILY YIELD.		Per cent. of fat in milk lost.	Per cent. of fat in milk recovered in butter.	Pounds of butter made for one pound of fat in milk.	Cost of food eaten.	Weight of animal.
		Pounds of fat in milk.	Pounds of fat in butter.	Pounds of butter containing 86 per cent. of butter fat.	Pounds of milk.		Pounds of milk.	Pounds of fat in milk.	Pounds of fat in butter.	Pounds of milk.	Pounds of butter.						
1.....	1891. November .....	5.69	5.53	6.51	15.36	404.5	23.02	23.37	26.33	13.5	0.88	2.81	97.19	1.14	\$3.00	794	
2.....	December .....	5.53	5.36	6.31	15.85	730.8	39.79	38.64	45.47	23.2	1.47	2.90	97.10	1.14	4.17	803	
3.....	1892. January .....	6.17	6.01	7.07	14.14	636.8	33.67	31.67	41.32	20.2	1.43	2.69	97.41	1.15	5.25	809	
4.....	February .....	5.95	5.79	6.81	14.68	506.7	30.14	29.84	34.51	17.5	1.19	2.69	97.31	1.14	4.46	811	
5.....	March .....	6.25	6.09	7.16	13.97	504.1	31.50	30.69	36.10	16.3	1.16	2.56	97.44	1.15	4.63	820	
6.....	April .....	6.32	6.16	7.25	13.79	491.1	31.04	30.25	35.60	15.4	1.19	2.53	97.47	1.15	4.60	826	
7.....	May .....	6.05	5.89	6.93	14.43	506.7	30.65	29.84	35.11	16.8	1.13	2.64	97.36	1.15	4.86	847	
8.....	June .....	5.05	4.89	5.75	17.39	453.9	22.32	22.30	26.11	15.1	0.87	3.17	96.83	1.14	4.83	835	
9.....	July .....	4.84	4.68	5.51	18.15	453.2	21.93	21.20	24.96	14.6	0.81	3.31	96.69	1.14	4.87	833	
10.....	August .....	6.43	6.27	7.38	13.51	349.8	22.49	21.93	25.81	11.3	0.83	2.49	97.51	1.15	3.84	820	
		5.82	5.66	6.66	15.00	501.8	29.23	28.40	33.41	16.5	1.10	2.75	97.25	1.14	\$4.51	825	

## JERSEY BUTTER RECORD — MONTHLY AVERAGES OF COUNTESS FLAVIA — THIRD PERIOD OF LACTATION.

Month of lactation.	DATE.	FROM 100 LBS. OF MILK.			Pounds of milk required to make one pound of butter.	MONTHLY YIELD OF MILK, ETC.				DAILY YIELD.		Per cent. of fat in milk lost.	Per cent. of fat in milk recovered in butter.	Pounds of butter made for one pound of fat in milk.	Cost of food eaten.	Weight of animal.
		Pounds of fat in milk.	Pounds of fat in butter.	Pounds of butter containing 85 per cent. of butter fat.		Pounds of milk.	Pounds of fat in milk.	Pounds of fat in butter.	Pounds of butter.	Pounds of milk.	Pounds of butter.					
1.....	1892. November .....	5.90	5.74	6.76	14.79	515.0	30.39	29.56	34.78	18.5	1.16	2.70	97.30	1.15	\$3.40	778
2.....	December .....	5.91	5.75	6.77	14.77	639.7	37.91	36.31	42.62	20.3	1.37	2.71	97.29	1.15	5.57	801
3.....	1893. January .....	6.37	6.21	7.31	13.66	560.5	35.70	34.81	40.96	18.1	1.31	2.51	97.49	1.15	5.14	837
4.....	February .....	6.35	6.09	7.16	13.97	477.1	59.82	29.06	34.17	17.0	1.22	2.56	97.44	1.15	5.16	839
5.....	March .....	6.05	5.89	6.93	14.43	531.4	31.54	30.71	36.13	16.8	1.17	2.64	97.36	1.15	5.35	837
6.....	April .....	6.30	6.04	7.11	14.06	406.4	30.77	29.98	35.18	16.5	1.18	2.58	97.43	1.15	5.06	878
7.....	May .....	6.23	6.16	7.25	13.79	479.8	30.32	29.55	34.78	15.5	1.13	2.53	97.47	1.15	4.61	835
8.....	June .....	6.05	5.89	6.93	14.43	304.6	23.99	23.36	27.46	15.3	0.98	2.64	97.36	1.15	3.68	893
9.....	July .....	6.08	5.92	6.96	14.37	363.2	23.08	21.50	25.99	11.7	0.83	2.63	97.37	1.15	2.76	853
10 .....	August .....	5.45	5.29	6.32	16.08	243.6	13.55	13.15	15.47	8.0	0.50	2.94	97.06	1.14	3.02	866
		6.09	5.93	6.98	14.33	463.8	23.54	27.80	33.79	15.4	1.08	2.63	97.38	1.15	\$4.30	820

JERSEY BUTTER RECORD — MONTHLY AVERAGES OF COUNTESS FLAVIA — FOURTH PERIOD OF LACTATION.

Month of lactation.	DATE.	FROM 100 LBS. OF MILK.			Pounds of milk required to make one pound of butter.	MONTHLY YIELD OF MILK, ETC.				DAILY YIELD.		Per cent. of fat in milk lost.	Per cent. of fat in milk recovered in butter.	Pounds of butter made for one pound of fat in milk.	Cost of food eaten.	Weight of animal.
		Pounds of fat in milk.	Pounds of fat in butter.	Pounds of butter containing 85 per cent. of butter fat.		Pounds of milk.	Pounds of fat in milk.	Pounds of fat in butter.	Pounds of butter.	Pounds of milk.	Pounds of butter.					
1.....	1893. November .....	5.37	5.31	6.12	16.84	570.0	30.61	30.70	35.00	19.0	1.17	2.98	97.08	1.14	\$3.63	763
2.....	December .....	6.01	5.85	6.88	14.54	731.8	43.98	42.81	50.37	23.5	1.63	2.66	97.34	1.15	5.14	827
3.....	1894. January .....	6.31	6.15	7.24	13.81	698.9	44.10	42.98	50.57	22.5	1.63	2.54	97.46	1.15	5.28	813
4.....	February .....	6.10	5.94	6.99	14.31	625.6	38.16	37.16	43.72	22.3	1.56	2.62	97.38	1.15	4.94	857
5.....	March .....	6.25	6.09	7.16	13.97	693.6	43.35	42.24	49.70	22.4	1.60	2.56	97.44	1.15	5.78	860
6.....	April .....	6.00	5.84	6.87	14.56	595.2	35.71	34.76	40.90	19.8	1.36	2.67	97.33	1.15	4.60	868
7.....	May .....	6.72	6.56	7.72	19.95	572.5	33.47	37.56	44.19	18.5	1.43	2.38	97.62	1.15	4.90	855
8.....	June .....	6.47	6.31	7.42	13.47	433.5	28.06	27.35	32.19	14.4	1.07	2.47	97.53	1.15	3.90	774
9.....	July .....	5.77	5.61	6.60	15.15	413.0	23.83	22.17	27.35	13.3	0.88	2.77	97.28	1.14	3.40	861
10.....	August .....	5.65	5.49	6.46	15.46	381.2	21.54	20.93	24.63	12.3	0.79	2.83	97.17	1.14	3.50	871
		6.09	5.93	6.98	14.33	571.5	34.73	33.89	39.87	18.8	1.31	2.60	97.40	1.15	\$4.51	889

## JERSEY BUTTER RECORD — MONTHLY AVERAGES OF GILDERBLOOM — FIRST PERIOD OF LACTATION.

Month of lactation.	DATE.	FROM 100 LBS. OF MILK.			Pounds of milk required to make one pound of butter.	MONTHLY YIELD OF MILK, ETC.				DAILY YIELD.		Per cent. of fat in milk lost.	Per cent. of fat in milk recovered in butter.	Pounds of butter made for one pound of fat in milk.	Cost of food eaten.	Weight of animal.
		Pounds of fat in milk.	Pounds of fat in butter.	Pounds of butter containing 88 per cent of butter fat.		Pounds of milk.	Pounds of fat in milk.	Pounds of fat in butter.	Pounds of butter.	Pounds of milk.	Pounds of butter.					
1.....	1890.															
2.....	September.....	6.10	5.94	6.99	14.81	486.0	29.64	28.86	33.97	16.2	1.13	2.62	97.88	1.15	\$3 12	770
3.....	October.....	5.82	5.46	6.42	15.58	535.6	30.10	29.35	34.41	17.3	1.11	2.85	97.15	1.14	4 52	784
4.....	November.....	5.19	5.08	5.92	16.89	473.8	24.59	23.83	28.05	15.8	0.94	3.08	96.92	1.14	4 84	744
5.....	December.....	6.16	6.00	7.06	14.16	410.7	25.80	24.04	28.99	13.2	0.94	2.60	97.40	1.15	4 49	736
6.....	1891.															
7.....	January.....	5.47	5.31	6.24	16.02	423.4	23.43	22.75	28.75	13.8	0.86	2.93	97.07	1.14	4 13	763
8.....	February.....	5.87	5.21	6.13	16.31	343.3	18.44	17.89	21.04	12.3	0.75	2.98	97.02	1.14	4 55	766
9.....	March.....	5.88	5.52	6.49	15.41	342.0	19.43	18.83	22.20	11.0	0.72	2.82	97.18	1.14	4 47	751
10.....	April.....	5.61	5.45	6.41	15.60	397.1	17.23	16.74	19.69	10.3	0.65	2.85	97.15	1.14	3 64	786
11.....	May.....	5.63	5.47	6.44	15.58	356.8	20.09	19.53	22.97	11.5	0.74	2.84	97.16	1.14	3 83	787
12.....	June.....	5.65	5.49	6.46	15.50	315.5	17.83	17.33	20.38	10.5	0.68	2.83	97.17	1.14	3 63	821
		5.66	5.49	6.46	15.50	400.0	22.61	21.96	25.84	13.2	0.85	2.83	97.17	1.14	\$4 17	769

JERSEY BUTTER RECORD — MONTHLY AVERAGES OF GILDEEBLOOM — THIRD PERIOD OF LACTATION.

Month of lactation.	DATE.	FROM 100 LBS. OF MILK.				MONTHLY YIELD OF MILK, ETC.				DAILY YIELD.		Per cent. of fat in milk lost.	Per cent. of fat in milk recovered in butter.	Pounds of butter made in for one pound of fat in milk.	Cost of food eaten.	Weight of animal.
		Pounds of fat in milk.	Pounds of fat in butter.	Pounds of butter containing 86 per cent. of butter fat.	Pounds of milk required to make one pound of butter.	Pounds of milk.	Pounds of fat in milk.	Pounds of fat in butter.	Pounds of butter.	Pounds of milk.	Pounds of butter.					
1.....	1893.	5.55	5.39	6.34	15.77	567.0	31.46	30.56	35.95	18.9	1.30	2.88	97.13	1.14	\$2.49	887
2.....	April.....	4.56	4.40	5.19	19.30	792.0	33.93	31.77	37.39	23.3	1.21	3.51	97.49	1.14	3.84	847
3.....	May.....	5.38	5.23	6.14	16.39	630.7	33.93	32.92	38.73	21.0	1.30	2.97	97.03	1.14	4.99	850
4.....	June.....	5.22	5.06	5.95	16.81	638.1	33.79	31.78	37.33	20.6	1.21	3.07	96.93	1.14	4.52	853
5.....	July.....	5.75	5.59	6.53	15.30	609.3	35.05	34.06	40.06	19.7	1.39	2.78	97.28	1.14	4.96	825
6.....	August.....	5.30	5.14	6.05	16.53	611.7	33.49	31.44	37.00	20.4	1.23	3.03	96.98	1.14	4.68	859
7.....	September.....	5.45	5.39	6.33	16.06	537.0	39.27	38.41	33.41	17.3	1.06	2.94	97.06	1.14	4.74	899
8.....	October.....	5.95	5.79	6.81	14.68	467.4	27.81	27.06	31.84	15.6	1.06	2.69	97.31	1.14	4.51	881
9.....	November.....	5.70	5.54	6.53	15.34	493.3	28.38	27.44	33.39	16.0	1.04	2.81	97.19	1.14	5.03	919
10.....	December.....	6.33	6.23	7.33	13.66	376.5	23.96	23.35	27.48	12.1	0.89	2.51	97.49	1.15	4.27	900
	1891.	5.45	5.39	6.33	16.03	554.4	30.78	29.86	35.12	18.5	1.15	2.94	97.06	1.14	\$4.33	864
	January.....															

## SHORTHORN BUTTER RECORD—MONTHLY AVERAGES OF BETSEY 10TH—FIRST PERIOD OF LACTATION.

Month of lactation.	DATE.	From 100 lbs. of MILK.			Pounds of milk required to make one pound of butter.	MONTHLY YIELD OF MILK, ETC.				DAILY YIELD.		Per cent. of fat in milk lost.	Per cent. of fat in milk recovered in butter.	Pounds of butter made for one pound of fat in milk.	Cost of food eaten.	Weight of animal.
		Pounds of fat in	Pounds of fat in	Pounds of butter containing 85 per cent.		Pounds of milk.	Pounds of fat in milk.	Pounds of butter.	Pounds of butter.	Pounds of milk.	Pounds of butter.					
1.....	1892. May .....	4.56	4.40	5.18	19.30	636.2	28.55	27.55	32.43	20.2	1.04	3.51	56.49	1.14	\$2 98	1080
2.....	June .....	4.02	3.86	4.54	22.03	667.1	27.02	26.52	31.20	22.9	1.04	3.98	96.02	1.13	3 83	976
3.....	July .....	3.92	3.76	4.42	22.62	650.6	26.50	24.46	28.77	21.0	0.93	4.08	95.92	1.13	3 46	935
4.....	August .....	3.18	3.72	4.38	22.83	531.6	20.68	19.78	23.27	17.2	0.76	4.12	96.88	1.13	3 68	863
5.....	September .....	3.95	3.79	4.45	22.42	495.5	16.81	16.13	18.98	14.3	0.63	4.05	96.96	1.13	2 85	833
6.....	October .....	4.15	3.99	4.69	21.32	433.7	18.00	17.51	20.85	14.0	0.66	3.85	96.14	1.13	4 09	899
7.....	November .....	4.45	4.29	5.06	19.80	487.8	19.46	18.78	22.10	14.6	0.74	3.60	96.40	1.13	5 73	901
8.....	December .....	4.42	4.26	5.01	19.96	445.2	19.63	18.97	22.31	14.4	0.72	3.63	96.38	1.13	6 96	932
9.....	1893. January .....	5.02	4.86	5.72	17.48	411.8	20.67	20.01	23.55	13.3	0.76	3.19	96.81	1.14	5 88	1044
10.....	February .....	4.80	4.64	5.46	18.31	389.4	17.73	17.14	20.17	13.2	0.72	3.33	96.67	1.14	5 32	1081
		4.28	4.12	4 85	20.62	501.9	21.47	20.68	24.33	16.5	0.80	3.74	96.36	1.13	\$4 40	948

## SHORTHORN BUTTER RECORD—MONTHLY AVERAGES OF BETSEY 10TH—SECOND PERIOD OF LACTATION.

Month of lactation.	DATE.	FROM 100 LBS OF MILK			Pounds of milk required to make one pound of butter.	MONTHLY YIELD OF MILK, ETC.				DAILY YIELD.		Per cent. of fat in milk lost.	Per cent. of fat in milk recovered in butter.	Pounds of butter made for one pound of fat in milk.	Cost of food eaten.	Weight of animal.
		Pounds of fat in milk.	Pounds of fat in butter.	Pounds of butter containing 85 per cent. of butter fat.		Pounds of milk.	Pounds of fat in milk.	Pounds of butter.	Pounds of fat in butter.	Pounds of milk.	Pounds of butter.					
1.....	1893. December.....	4.49	4.33	5.09	19.65	886.6	39.81	88.39	45.16	28.6	1.46	4.56	96.44	1.13	\$3.62	1067
2.....	1894 January.....	4.62	4.46	5.35	19.05	941.1	43.49	41.97	49.41	30.4	1.60	3.46	96.54	1.13	5.75	1077
3.....	February.....	4.53	4.36	5.16	19.49	793.9	35.39	94.13	40.40	27.9	1.43	3.54	96.46	1.13	5.24	1110
4.....	March.....	4.63	4.46	5.25	19.05	836.6	38.19	31.87	48.40	26.7	1.40	3.47	96.53	1.13	6.17	1106
5.....	April.....	4.72	4.56	5.36	18.66	693.0	32.71	31.80	37.14	23.1	1.24	3.39	16.61	1.14	5.33	11.7
6.....	May.....	4.75	4.59	5.40	18.52	662.2	30.98	29.94	35.23	21.0	1.13	3.27	96.63	1.14	5.01	1083
7.....	June.....	4.45	4.29	5.05	19.80	584.2	26.00	25.06	29.51	19.5	0.96	3.60	96.40	1.13	4.63	1102
8.....	July.....	4.50	4.34	5.11	19.57	597.9	26.91	26.95	30.55	19.3	0.99	3.66	96.44	1.13	4.46	1094
9.....	August.....	4.55	4.39	5.16	19.38	596.6	27.15	26.19	30.73	19.2	0.99	3.63	96.43	1.13	4.61	1099
0.....	September.....	4.27	4.11	4.83	20.70	530.0	21.63	21.73	25.62	17.7	0.85	3.75	96.25	1.13	3.61	1132
		4.55	4.40	5.18	19.30	709.1	32.38	31.30	36.70	23.3	1.21	3.50	96.50	1.13	\$4.65	1098

## VIII. CHARACTER AND EXTENT OF INVESTIGATION MADE RELATING TO THE MANUFACTURE OF CHEESE DURING THE SEASON OF 1894.

The main object sought in continuing our investigation at cheese factories during the season of 1894 was to study the composition of the milk, especially with reference to its variations in composition, in order to see in what manner and to what extent the season might influence the composition. Since the results secured during the season of 1893 at different factories were found to differ little in their averages, it was thought that quite as satisfactory results could be secured by confining the work to a single factory.

Mr. Merry kindly offered to co-operate in the work again. The work began in May and continued through October. Thus, we secured a record of 22 weeks and can rely upon this record as representing very closely the average of the whole season's work, as well as the average of each week and month of the whole season. Soon after the 1st of October, the manufacture of skim-milk cheese and butter was begun at Mr. Merry's factory and the study of the cheese was, therefore, discontinued, as this investigation was planned to deal only with normal milk. However, as the patrons continued to deliver normal milk, the skimming all being done at the factory, arrangements were made with Mr. Merry to send samples of the normal mixed milk during October. The work done represents milk from 650 cows, consisting largely of natives, with some grade Ayrshires and Holsteins. The milk yields on the particular days on which work was done varied from 8,643 to 14,232 pounds and aggregated 256,589 pounds.

If we take the yield for six months, from May to October, inclusive, the work done may be considered as representing the average results secured from handling not less than one and one-half million pounds of milk.

The points covered by the investigation were practically the same as during the previous seasons.

In the work, the results of which are presented in this report, the Station secured the co-operation of Mr. G. Merry, of Verona, Oneida county, New York. The cheese-making, sampling and keeping of notes were done by Mr. Fred. H. Merry. The Station Chemist has had charge of the investigation on the part of the Station.

For work previously done, see bulletins 37, 43, 45, 46, 47, 50, 54, 56, 60, 61, 62, 65, 68, and 71.

## X. SUMMARY OF RESULTS RELATING TO CONDITIONS OF MANUFACTURE.

## TABULATED STATEMENT OF THE CONDITIONS OF MANUFACTURE.

No.	DATE.	Pounds of milk used.	Pounds of green cheese made.	Condition of milk.	Temperature of milk added. Deg. F.	Kind of rennet extract used.	Ounces of rennet extract used per 1000 pounds of milk.	Time for milk to coagulate completely. Min.	Highest temperature used for heating curd. Deg. F.	Time taken to heat to min. temperature.	Time from reaching highest temperature to draw whey. Min.	Length of sitting on hot iron when whey was drawn. Inches.	Time from drawing whey to straining curd. Min.	Pounds of salt used per 1000 pounds of milk.	Length of string on hot iron when curd was ground. Inches.	Condition of curd.	Temperature of curd when put in press. Deg. F.	Time of whole operation after adding rennet. H.
988	May 9 '94	10,119	1034	Good	84	Blumenthal's	4 1/2	95	100	89	190	5 1/2	90	148	1 1/2	Good	88	9 1/2
989	May 10 '94	12,197	1331	Good	85	Blumenthal's	4 1/2	95	100	79	170	1 1/2	100	224	1 1/2	Good	87	8 15
990	May 21 '94	13,061	1336	Good	85	Blumenthal's	4 1/2	95	100	79	180	1 1/2	110	224	1 1/2	Good	87	8 45
991	May 23 '94	13,085	1374	Good	86	Blumenthal's	4 1/2	95	100	79	235	1 1/2	110	224	1 1/2	Good	87	8 45
992	June 5 '94	13,740	1440	Good	86	Blumenthal's	4 1/2	95	99	82	145	1 1/2	125	224	1 1/2	Good	86	9 00
993	June 6 '94	14,694	1579	Slightly tain'd	84	Blumenthal's	4 1/2	95	100	89	90	1 1/2	110	224	1 1/2	Trace of faint	84	9 00
994	June 12 '94	13,232	1575	Slightly tain'd	84	Blumenthal's	4 1/2	95	100	89	90	1 1/2	110	224	1 1/2	Trace of faint	84	9 00
995	June 27 '94	13,667	1528	Tainted & ripe	83	Blumenthal's	4 1/2	95	101	89	165	1 1/2	120	224	1 1/2	Tainted & gasy	83	9 00
996	July 1 '94	13,668	1529	Tainted	83	Blumenthal's	4 1/2	95	100	89	165	1 1/2	120	224	1 1/2	Tainted & gasy	83	9 00
997	July 4 '94	13,668	1529	Tainted	83	Blumenthal's	4 1/2	95	100	89	165	1 1/2	120	224	1 1/2	Tainted & gasy	83	9 00
998	July 15 '94	13,668	1529	Tainted	84	Peeries	4 1/2	95	101	72	120	1 1/2	100	224	1 1/2	Good	87	9 40
999	July 25 '94	13,668	1529	Tainted	84	Peeries	4 1/2	95	100	72	120	1 1/2	100	224	1 1/2	Good	87	9 40
1000	Aug. 5 '94	11,832	1192	Good	84	Peeries	4 1/2	95	99	92	165	1 1/2	110	224	1 1/2	Tainted & gasy	83	9 40
1001	Aug. 6 '94	11,843	1196	Slightly tain'd	84	Peeries	4 1/2	95	100	90	140	1 1/2	110	224	1 1/2	Tainted & gasy	83	9 40
1002	Aug. 10 '94	11,843	1196	Ripe	84	Peeries	4 1/2	95	100	90	140	1 1/2	110	224	1 1/2	Floating	83	9 40
1003	Aug. 20 '94	10,577	106	Tainted	84	Peeries	4 1/2	95	100	70	100	1 1/2	100	224	1 1/2	Good	83	9 40
1004	Aug. 23 '94	10,577	106	Good	84	Peeries	4 1/2	95	99	70	100	1 1/2	100	224	1 1/2	Good	83	9 40
1005	Aug. 23 '94	10,577	106	Good	84	Peeries	4 1/2	95	99	70	100	1 1/2	100	224	1 1/2	Good	83	9 40
1006	Aug. 23 '94	10,577	106	Good	84	Peeries	4 1/2	95	99	70	100	1 1/2	100	224	1 1/2	Good	83	9 40
1007	Aug. 23 '94	10,577	106	Good	84	Peeries	4 1/2	95	99	70	100	1 1/2	100	224	1 1/2	Good	83	9 40
1008	Sept. 1 '94	10,169	1019	Tainted	83	Peeries	4 1/2	95	99	68	100	1 1/2	120	224	1 1/2	Gasy	82	15
1009	Sept. 1 '94	9,161	955	Good	83	Peeries	4 1/2	95	99	68	100	1 1/2	120	224	1 1/2	Good	84	15
1010	Sept. 10 '94	9,161	955	Good	83	Peeries	4 1/2	95	99	68	100	1 1/2	120	224	1 1/2	Good	84	15
1011	Sept. 10 '94	9,161	955	Good	83	Peeries	4 1/2	95	99	68	100	1 1/2	120	224	1 1/2	Good	84	15
1012	Oct. 1 '94	8,841	955	Good	83	Peeries	4 1/2	95	99	68	100	1 1/2	120	224	1 1/2	Good	84	15

While we can not draw any definite general conclusions from a study of the conditions of manufacture in respect to many important points, it is a matter of interest to consider briefly some of the more prominent facts observed. We present, in tabulated form, an outline of the data secured during the season in regard to the following points:

1. Ounces of rennet-extract used for 1000 pounds of milk.
2. Temperature of milk when rennet was added.
3. Time required for rennet to coagulate the milk completely.
4. Temperature to which curd was heated after being cut.
5. Time from cutting curd to drawing whey.
6. Length of string on hot iron when whey was drawn.
7. Time from drawing whey to putting curd in press.
8. Length of string on hot iron when curd was put in press.
9. Temperature of curd when put in press.
10. Time consumed in operation of cheese-making after adding rennet.

1. OUNCES OF RENNET-EXTRACT USED FOR 1000 POUNDS OF MILK.

1894.	May.	June.	July.	August.	September.	Average for season.
Least .....	4½	3½	3½	3½	3½	.....
Greatest .....	4½	4½	3½	3½	3½	.....
Average .....	4½	4	3½	3½	3½	3¾

The amount of rennet-extract used varied from 3½ to 4½ ounces per 1,000 pounds of milk and averaged 3¾ ounces during the season. Two kinds of rennet-extract were used, "Blumenthal's" and "Peerless."

2. TEMPERATURE OF MILK WHEN RENNET WAS ADDED.

1891.	May.	June.	July.	August.	September.	Average for season.
	Deg. F.	Deg. F.	Deg. F.	Deg. F.	Deg. F.	Deg. F.
Least ....	84	83	83	84	84	.....
Greatest .....	86	84	84	84	85	.....
Average .....	85	83½	83½	84	84½	84

The temperature of the milk when the rennet was added varied 83° to 86° F., but was about 84° F. most of the time.

### 3. TIME REQUIRED FOR RENNET TO COAGULATE THE MILK COMPLETELY.

1894.	May.	June.	July.	August.	September.	Average for season.
	Min.	Min.	Min.	Min.	Min.	Min.
Least .....	27	30	25	30	35	.....
Greatest .....	45	35	45	45	40	.....
Average ..	34	33	34	36	37	35

The time required for the rennet to coagulate the milk completely, ready for cutting, varied from 25 to 45 minutes and averaged 35 minutes for the season.

### 4. TEMPERATURE TO WHICH CURD WAS HEATED AFTER BEING CUT.

1894.	May.	June.	July.	August.	September.	Average for season.
	Deg. F.	Deg. F.	Deg. F.	Deg. F.	Deg. F.	Deg. F.
Least .....	100	99	100	99	99	.....
Greatest .....	100	101	101	100	99	.....
Average .....	100	100	100½	99½	99	100

The temperature to which the curd was heated after being cut varied from 99° F. to 101° F., and averaged 100° F. for the season.

### 5. TIME FROM CUTTING CURD TO DRAWING WHEY.

1894.	May.	June.	July.	August.	September.	Average for season.
	Hrs. Min.	Hrs. Min.	Hrs. Min.	Hrs. Min.	Hrs. Min.	Hrs. Min.
Least ...	4 5	2 35	3 00	3 00	2 45	.....
Greatest .....	5 00	4 10	3 53	4 10	4 30	.....
Average .....	4 23	3 19	3 29	3 42	3 45	3 43

The length of time between cutting the curd and drawing the whey varied from 2 hours and 35 minutes to 5 hours and averaged 3 hours and 43 minutes for the season.

## 6. LENGTH OF STRING ON HOT IRON WHEN WHEY WAS DRAWN.

1894.	May.	June.	July.	August.	September.	Average for season.
	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.
Least .....	$\frac{1}{8}$	$\frac{1}{4}$	$\frac{1}{4}$	$\frac{1}{4}$	$\frac{1}{3}$	.....
Greatest .....	$\frac{1}{4}$	$\frac{1}{4}$	$\frac{1}{3}$	$\frac{1}{3}$	$\frac{1}{3}$	.....
Average .....	$\frac{1}{4}$	$\frac{1}{4}$	$\frac{1}{4}$	$\frac{1}{3}$	$\frac{1}{3}$	$\frac{1}{3}$

The length of string formed by the curd on a hot iron, when the whey was taken from the curd, varied from one-eighth to one-half of an inch and averaged one-third of an inch for the season.

## 7. TIME FROM DRAWING WHEY TO PUTTING CURD IN PRESS.

1894.	May.	June.	July.	August.	September.	Average for season.
	Min.	Min.	Min.	Min.	Min.	hrs. Min.
Least .....	90	90	100	75	75	.....
Greatest .....	110	125	135	170	120	.....
Average .....	103	105	117	115	104	1 50

The time from drawing whey to putting curd in press varied from 1 hour and 15 minutes to 2 hours and 50 minutes and averaged 1 hour and 50 minutes for the season.

## 8. LENGTH OF STRING ON HOT IRON WHEN CURD WAS PUT IN PRESS.

1894.	May.	June.	July.	August.	September.	Average for season.
	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.
Least .....	$\frac{1}{2}$	$1\frac{1}{2}$	$1\frac{1}{4}$	$1\frac{1}{2}$	$1\frac{1}{2}$	.....
Greatest .....	$1\frac{1}{2}$	$1\frac{1}{2}$	$1\frac{1}{2}$	$1\frac{1}{2}$	2	.....
Average .....	1	$1\frac{1}{2}$	$1\frac{3}{8}$	$1\frac{1}{2}$	$1\frac{3}{4}$	$1\frac{1}{2}$

The length of string formed by the curd on a hot iron, when the curd was put in press, varied from one-half of an inch to two inches, and averaged one and one-half inches for the season.

## 9. TEMPERATURE OF CURD WHEN PUT IN PRESS.

1894.	May.	June.	July.	August.	September.	Average for season.
	Deg. F.	Deg. F.	Deg. F.	Deg. F.	Deg. F.	Deg. F.
Least .....	83	84	84	83	83	.....
Greatest .....	87	86	87	85	87	.....
Average .....	86	85	86	84	85	85

The temperature of the curd, when put in press, varied from 83° to 87° F., and averaged 85° F. for the season.

## 10. TIME CONSUMED IN OPERATION OF CHEESE-MAKING AFTER ADDING RENNET.

1894.	May.	June.	July.	August.	September.	Average for season.
	Hrs. Min.	Hrs. Min.	Hrs. Min.	Hrs. Min.	Hrs. Min.	Hrs. Min.
Least .....	6 15	4 00	5 45	6 00	5 20	.....
Greatest .....	6 45	7 00	6 50	7 00	7 15	.....
Average .....	6 34	5 28	6 25	6 35	6 20	6 16

The time occupied by the operation of cheese-making, after adding the rennet, varied from 4 hours to 7 hours and 15 minutes, and averaged 6 hours and 16 minutes.

## XI. A STUDY OF THE COMPOSITION OF MILK DURING SEASON.

In addition to the data presented previously in our analyses of milk, we now give a more detailed statement by separating what we have hitherto called albumen into two separate constituents; one, albumen, and the other, albumose. The character and quantity of these compounds in milk we shall discuss later under a special head.

We also present detailed data showing the relation of fat to the casein in milk of three different herds of cows, one being the herd giving the richest milk taken to Mr. Merry's factory, and the other two giving the milk poorest in fat.

The milk studied represents the mixed morning and evening normal milk of numerous herds of cows. Since most dairymen,

who take their milk to cheese factories, have their cows come in milk in the spring, our data represent the changes due to the advance of the period of lactation, modified, to a greater or less extent, by special conditions, such as food, weather, etc.

We shall take up this study of the composition of milk under the following heads :

1. Pounds of solids in 100 pounds of milk.
2. Pounds of solids not fat in 100 pounds of milk.
3. Pounds of cheese-producing solids (fat and casein) in 100 pounds of milk.
4. Pounds of whey solids (albumen, sugar, etc.) in 100 pounds of milk.
5. Pounds of fat in 100 pounds of milk.
6. Pounds of nitrogen compounds (casein, albumen and albumose) in 100 pounds of milk.
7. Pounds of casein in 100 pounds of milk.
8. Pounds of albumen in 100 pounds of milk.
9. Pounds of albumose in 100 pounds of milk.
10. Relation of casein to albumen and albumose in normal milk.
11. Relation of fat to casein in normal milk.
12. General summary of results.

TABLE SHOWING THE COMPOSITION OF MILK DURING THE SEASON.

DATE.	Per cent. of water.	Per cent. of solids.	Per cent. of fat.	Per cent. of solids, not fat.	Per cent. of nitrogen compounds.	Per cent. of casein.	Per cent. of albumen.	Per cent. of albu- nose.	Per cent. of sugar, ash, etc.
1894.									
May 9.....	87.42	12.58	3.80	8.78	3.14	2.37	0.34	0.43	5.64
May 16.....	87.38	12.62	3.60	9.02	3.16	2.45	0.33	0.38	5.86
May 23.....	87.38	12.62	3.60	9.02	3.14	2.48	0.29	0.37	5.88
May 30.....	87.41	12.59	3.50	9.09	3.14	2.45	0.33	0.36	5.95
Average for May.....	87.40	12.60	3.63	8.97	3.14	2.44	0.32	0.38	5.83
June 6.....	87.13	12.87	3.60	9.27	3.24	2.54	0.31	0.39	6.03
June 13.....	87.71	12.29	3.50	8.79	3.11	2.33	0.29	0.49	5.68
June 20.....	87.66	12.34	3.50	8.84	3.00	2.29	0.28	0.43	5.84
June 27.....	87.63	12.37	3.60	8.77	2.94	2.22	0.28	0.44	5.83
Average for June.....	87.53	12.47	3.55	8.92	3.07	2.35	0.29	0.43	5.85
July 4.....	87.60	12.40	3.70	8.70	2.94	2.27	0.29	0.38	5.76
July 11.....	87.64	12.36	3.55	8.81	3.06	2.36	0.28	0.42	5.75
July 18.....	87.68	12.32	3.40	8.92	2.98	2.19	0.29	0.50	5.94
July 25.....	87.57	12.43	3.70	8.73	3.01	2.21	0.28	0.47	5.72
Average for July.....	87.63	12.37	3.59	8.78	3.00	2.27	0.29	0.44	5.78

August 1.....	87.66	12.34	3.70	8.64	3.01	2.31	0.30	0.40	5.63
August 15.....	87.59	12.41	3.80	8.61	3.03	2.28	0.33	0.42	5.58
August 22.....	87.37	12.63	3.80	8.83	3.11	2.35	0.29	0.47	5.73
August 29.....	87.41	12.59	3.80	8.79	3.04	2.35	0.30	0.39	5.75
Average for August .....	87.51	12.49	3.78	8.71	3.05	2.32	0.31	0.42	5.63
September 5 .....	87.40	12.00	3.80	8.80	2.98	2.35	0.31	0.32	5.82
September 12 .....	87.27	12.73	3.90	8.83	3.03	2.25	0.36	0.42	5.80
September 19 .....	87.55	12.45	3.45	9.00	3.13	2.39	0.33	0.41	5.87
September 26 .....	87.10	12.90	3.85	9.05	3.26	2.65	0.36	0.25	5.79
Average for September .....	87.33	12.67	3.75	8.92	3.10	2.41	0.34	0.35	5.82
October 3.....	87.23	12.77	3.85	8.92	3.27	2.51	0.34	0.42	5.65
October 10.....	86.96	13.04	4.00	9.04	3.36	2.58	0.38	0.40	5.68
October 17.....	86.61	13.39	4.10	9.29	3.34	2.64	0.34	0.36	5.95
October 24.....	86.66	13.34	4.10	9.24	3.46	2.63	0.36	0.47	5.78
October 31.....	86.84	13.16	3.90	9.26	3.39	2.66	0.37	0.36	5.87
Average for October.....	86.87	13.13	4.00	9.13	3.36	2.60	0.36	0.40	5.77

## 1. POUNDS OF SOLIDS IN 100 POUNDS OF MILK.

	May.	June.	July.	August.	Septem- ber.	October.	Average for season.
Least .....	12.58	12.29	12.32	12.34	12.45	12.77	.....
Greatest ...	12.62	12.87	12.43	12.63	12.90	13.39	.....
Average...	12.60	12.47	12.37	12.49	12.67	13.13	12.62

The solids in 100 pounds of milk varied from 12.29 to 13.39 pounds, and averaged 12.62 pounds during the season. The average for the whole season is the same as in 1893. Compared month by month, there are some marked differences between the seasons of 1893 and 1894, especially during the months of September and October, when the solids increased less during 1894. This is undoubtedly accounted for by the prolonged drouth during August. It will be seen that the amount of solids dropped in June and still further in July and then increased each month following. The abrupt fall of solids on September 19 was probably due to the fact that just before that date, the cows began to receive an abundant supply of succulent food in the form of the by-products of a corn-canning factory.

## 2. POUNDS OF SOLIDS-NOT-FAT IN 100 POUNDS OF MILK.

	May.	June.	July.	August.	Septem- ber.	October.	Average for season.
Least .....	8.78	8.77	8.70	8.61	8.80	8.92	.....
Greatest ...	9.09	9.27	8.92	8.83	9.05	9.29	.....
Average...	8.97	8.92	8.78	8.71	8.92	8.13	8.89

a. The amount of solids, exclusive of the fat, in 100 pounds of milk varied from 8.61 to 9.29 pounds, and averaged 8.89 pounds during the season.

b. The amount of solids-not-fat decreased during June, July and August, after which there was an increase.

3. POUNDS OF CHEESE-PRODUCING SOLIDS (FAT AND CASEIN) IN 100 POUNDS OF MILK.

	May.	June.	July.	August.	Septem-ber.	October.	Average for season.
Least .....	5.95	5.79	5.59	6.01	5.85	6.36	.....
Greatest ..	6.17	6.14	5.97	6.15	6.50	6.74	.....
Average ..	6.07	5.90	5.86	6.10	6.16	6.60	6.14

*a.* The amount of cheese-producing solids (fat and casein) in 100 pounds of milk varied from 5.59 to 6.44 pounds, and averaged 6.14 pounds during the season.

*b.* The cheese-producing solids decreased during June and July, but increased during August, September and October.

4. POUNDS OF WHEY-SOLIDS (ALBUMEN, SUGAR, ETC.) IN 100 POUNDS OF MILK.

	May.	June.	July.	August.	Septem-ber.	October.	Average for season.
Least. ....	6.41	6.46	6.43	6.33	6.40	6.41	.....
Greatest ..	6.64	6.73	6.73	6.48	6.61	6.65	.....
Average ..	6.53	6.57	6.51	6.39	6.51	6.53	6.49

*a.* The amount of whey-solids (albumen, sugar, etc.) in 100 pounds of milk varied from 6.33 to 6.73 pounds, and averaged 6 pounds during the season.

*b.* The whey-solids decreased in August and remained very uniform during the other months.

5. POUNDS OF FAT IN 100 POUNDS OF MILK.

	May.	June.	July.	August.	Septem-ber.	October.	Average for season.
Least .....	3.50	3.50	3.40	3.70	3.45	3.85	.....
Greatest ..	3.80	3.60	3.70	3.80	3.90	4.10	.....
Average ..	3.63	3.55	3.59	3.78	3.75	4.00	3.73

a. The amount of fat in 100 pounds of milk varied from 3.40 to 4.60 pounds, and averaged 3.73 pounds during the season.

b. The milk-fat decreased in June and increased in July, August, September and October.

#### 6. POUNDS OF NITROGEN COMPOUNDS (CASEIN, ALBUMEN AND ALBUMOSE) IN 100 POUNDS OF MILK.

	May.	June.	July.	August.	September.	October.	Average for season.
Least . . . .	3.14	2.94	2.94	3.01	2.98	3.27	.....
Greatest ..	3.16	3.24	3.06	3.11	3.26	3.46	.....
Average ..	3.14	3.07	3.00	3.05	3.10	3.36	3.13

a. The amount of nitrogen compounds present in 100 pounds of milk varied from 2.94 to 3.46 pounds, and averaged 3.13 pounds during the season.

b. The nitrogen compounds in the milk decreased from May, remaining quite uniform through June, July, August and September, but again increased in October.

#### 7. POUNDS OF CASEIN IN 100 POUNDS OF MILK.

	May.	June.	July.	August.	September.	October.	Average for season.
Least . . . .	2.37	2.22	2.19	2.22	2.25	2.56	.....
Greatest ..	2.48	2.54	2.36	2.35	2.65	2.66	.....
Average ..	2.44	2.35	2.27	2.32	2.41	2.60	2.41

a. The amount of casein in 100 pounds of milk varied from 2.19 to 2.66 pounds, and averaged 2.46 pounds during the season.

b. The casein decreased during June and July, and then increased during each month following.

#### 8. POUNDS OF ALBUMEN IN 100 POUNDS OF MILK.

	May.	June.	July.	August.	September.	October.	Average for season.
Least . . . .	0.29	0.28	0.28	0.29	0.31	0.34	.....
Greatest . .	0.34	0.31	0.29	0.33	0.36	0.38	.....
Average . . .	0.32	0.29	0.29	0.31	0.34	0.36	0.32

*a.* The amount of albumen in 100 pounds of milk varied from 0.28 to 0.38 and averaged 0.32 pounds during the season.

*b.* The albumen decreased in June, remaining the same until August, and then increased.

9. POUNDS OF ALBUMOSE IN 100 POUNDS OF MILK.

	May.	June.	July.	August.	Septem- ber.	October.	Average for season.
Least .....	0.36	0.39	0.38	0.39	0.30	0.36	.....
Greatest...	0.43	0.49	0.50	0.47	0.42	0.47	.....
Average...	0.38	0.43	0.44	0.42	0.35	0.40	0.40

*a.* The amount of albumose varied from 0.30 to 0.50 pounds and averaged 0.40 pounds in 100 pounds of milk during the season.

*b.* The albumose increased as the season advanced, except in August and September, when there was a decrease.

10. RELATION OF CASEIN TO ALBUMEN AND ALBUMOSE IN NORMAL MILK.  
*Table Showing Relation of Nitrogen Compounds in Milk.*

DATE.	Per cent. of nitrogen compounds in milk.	Per cent. of casein in milk.	Per cent. of albumen in milk.	Per cent. of albumose in milk.	Pounds of casein for 100 pounds of nitrogen compounds.	Pounds of albumen for 100 pounds of nitrogen compounds.	Pounds of albumose for 100 pounds of nitrogen compounds.	Pounds of casein for one pound of albumen and albumose in milk.	Pounds of albumose for one pound of albumen in milk.
1894.									
May 9.....	3.14	2.37	0.34	0.43	75.48	10.82	13.70	3.25	1.26
May 16.....	3.16	2.45	0.33	0.38	77.53	10.44	12.03	3.45	1.16
May 23.....	3.14	2.48	0.29	0.37	79.00	9.23	11.77	3.76	1.28
May 30.....	3.14	2.45	0.33	0.36	78.02	10.51	11.47	3.55	1.09
Average for May. ....	3.14	2.44	0.32	0.38	77.71	10.19	12.10	3.49	1.19
June 6.....	3.24	2.54	0.31	0.39	78.40	9.57	12.03	3.63	1.26
June 13.....	3.11	2.33	0.29	0.49	74.92	9.33	15.75	3.00	1.69
June 20.....	3.00	2.29	0.28	0.43	76.33	9.33	14.34	3.23	1.54
June 27.....	2.94	2.22	0.28	0.44	75.51	9.52	14.97	3.08	1.57
Average for June .....	3.07	2.35	0.29	0.43	76.55	9.45	14.00	3.26	1.48
July 4.....	2.94	2.27	0.29	0.38	77.21	9.86	12.93	3.40	1.31
July 11.....	3.06	2.36	0.28	0.42	77.12	9.15	13.73	3.37	1.50

July 18.....	2.98	2.19	0.29	0.50	73.49	9.73	16.78	2.80	1.72
July 25.....	3.01	2.26	0.28	0.47	75.08	9.30	15.62	3.01	1.68
Average for July.....	3.00	2.27	0.29	0.44	75.66	9.67	14.67	3.11	1.52
August 1.....	3.01	2.31	0.30	0.40	76.74	9.97	13.29	3.30	1.33
August 15.....	3.03	2.28	0.33	0.42	75.25	10.90	13.85	3.04	1.27
August 22.....	3.11	2.35	0.29	0.47	75.57	9.32	15.11	3.09	1.62
August 29.....	3.04	2.35	0.30	0.39	77.30	9.87	12.83	3.41	1.28
Average for August.....	3.05	2.32	0.31	0.42	76.07	10.16	13.77	3.18	1.35
September 5.....	2.98	2.35	0.31	0.32	78.86	10.40	10.74	3.73	1.03
September 12.....	3.03	2.25	0.36	0.42	74.26	11.88	13.86	2.90	1.17
September 19.....	3.13	2.39	0.33	0.41	76.36	10.54	13.10	3.25	1.24
September 26.....	3.26	2.65	0.36	0.25	81.29	11.4	7.67	4.34	0.70
Average for September.....	3.10	2.41	0.34	0.35	77.74	10.97	11.29	3.50	1.03
October 3.....	3.27	2.51	0.34	0.42	76.76	10.40	12.84	3.30	1.23
October 10.....	3.36	2.58	0.38	0.40	66.80	11.31	11.89	3.31	1.05
October 17.....	3.34	2.64	0.34	0.36	79.04	10.18	10.78	3.77	1.06
October 24.....	3.46	2.63	0.36	0.47	76.01	10.40	13.54	3.17	1.30
October 31.....	3.39	2.66	0.37	0.36	78.47	10.91	10.62	3.64	0.97
Average for October.....	3.36	2.60	0.36	0.40	77.38	10.71	11.91	3.42	1.11

We will state here the characteristics of the three different nitrogen compounds of milk. Casein is that portion of the milk which is coagulated by rennet and acids, but not by heat alone. Albumen is that portion of milk coagulated by heat, but not by acids or rennet. Albumose is that portion of milk coagulated by neither heat, rennet nor acids; it, therefore, remains in solution under those conditions which cause the coagulation of casein and albumen. There has been for some time a question as to the possibility of holding all the nitrogen compounds of milk in cheese by some practical method. It has been supposed that the albumen formed most of the nitrogen compounds remaining after the removal of casein; but, as will be seen, our figures show that the larger portion of what we have called albumen is albumose, and that heat has no effect in coagulating it. Hence, if there were a practicable method of retaining albumen in cheese, we should be able to retain only one-third of a pound for 100 pounds of milk, instead of three-fourths of a pound, as has previously been expected.

TABLE SHOWING PROPORTION OF CASEIN IN THE NITROGEN COMPOUNDS OF MILK.

	May.	June.	July.	August.	September.	October.	Average for season.
Least .....	75.48	74.92	73.49	75.25	74.26	76.01	.....
Greatest ..	79.00	78.40	77.21	77.30	81.29	79.04	.....
Average ..	77.71	76.55	75.66	76.07	77.74	77.38	77.00

a. The proportion of nitrogen compounds in milk that consisted of casein varied from 73.49 to 81.29 per cent., and averaged 77 per cent.

b. The proportion of casein in the nitrogen compounds of milk decreased in June and July, and then increased during the remainder of the season.

TABLE SHOWING POUNDS OF CASEIN FOR ONE POUND OF ALBUMEN AND ALBUMOSE IN MILK.

	May.	June.	July.	August	Septem-ber.	October.	Average for season.
Least .....	3.25	3.00	2.80	3.04	2.90	3.17	.....
Greatest ..	3.76	3.63	3.40	3.41	4.34	3.77	.....
Average...	3.49	3.26	3.11	3.18	3.50	3.42	3.35

a. For each pound of albumen and albumose in milk, the casein varied from 2.80 to 4.34 pounds, and averaged 3.35 pounds for the season.

b. The amount of casein, relative to albumen and albumose, decreased during June and July, and then increased.

TABLE SHOWING PROPORTION OF ALBUMEN IN THE NITROGEN COMPOUNDS OF MILK.

	May.	June.	July.	August.	Septem-ber.	October.	Average for season.
Least .....	9.23	9.33	9.15	9.32	10.40	10.18	.....
Greatest ..	10.82	9.57	9.86	10.90	11.88	11.31	.....
Average...	10.19	9.45	9.67	10.16	10.97	10.71	10.22

a. The proportion of nitrogen compounds that consisted of albumen varied from 9.15 to 11.88 per cent., and averaged 10.22 per cent.

b. The proportion of albumen in the nitrogen compounds of milk decreased in June, and then increased.

TABLE SHOWING PROPORTION OF ALBUMOSE IN THE NITROGEN COMPOUNDS OF MILK.

	May.	June.	July.	August.	Septem-ber.	October.	Average for season.
Least .....	11.47	12.03	12.93	12.83	7.67	10.62	.....
Greatest ..	13.70	15.75	16.78	15.11	13.86	13.59	.....
Average...	12.10	14.00	14.67	13.77	11.29	11.91	12.78

a. The proportion of nitrogen compounds that consisted of albumose varied from 7.67 to 16.78 per cent., and averaged 12.78 per cent.

b. The proportion of albumose in the nitrogen compounds of milk increased in June and July, and then decreased.

TABLE SHOWING POUNDS OF ALBUMOSE FOR ONE POUND OF ALBUMEN IN MILK.

	May	June.	July.	August.	September.	October	Average for season.
Least .....	1.09	1.26	1.31	1.27	0.70	0.97	.....
Greatest ..	1.28	1.69	1.72	1.62	1.24	1.30	.....
Average ..	1.19	1.48	1.52	1.35	1.03	1.11	1.24

a. For each pound of albumen in milk, the albumose varied from 0.70 to 1.72 pounds, and averaged 1.24 pounds for the season.

b. The amount of albumose, relative to albumen, increased during June and July, and then decreased.

TABULATED SUMMARY SHOWING RELATION OF DIFFERENT NITROGEN COMPOUNDS OF MILK.

	May.	June.	July.	August	Sept.	Oct.	Average for season.
Per cent. of nitrogen compounds...	3.14	3.07	3.00	3.03	3.10	3.36	3.13
Per cent. of casein .....	2.44	2.35	2.37	2.32	2.41	2.60	2.41
Per cent. of albumen .....	0.32	0.29	0.29	0.31	0.34	0.36	0.32
Per cent. of albumose .....	0.38	0.43	0.44	0.42	0.35	0.40	0.40
Proportion of casein in nitrogen compounds .....	77.71	76.55	75.66	76.07	77.74	77.38	77.00
Proportion of albumen in nitrogen compounds .....	10.19	9.45	9.67	10.16	10.97	10.71	10.32
Proportion of albumose in nitrogen compounds .....	12.10	14.00	14.67	13.77	11.39	11.91	12.78
Pounds of casein for one pound of albumen and albumose .....	3.49	3.26	3.11	3.18	3.50	3.42	3.35
Pounds of albumose for one pound of albumen .....	1.19	1.48	1.52	1.35	1.03	1.11	1.24

An examination of the data contained in the foregoing table shows that, when the nitrogen compounds in milk increase, the casein increases also, but in a larger proportion than the other

compounds. From this it would appear that, of two milks, the one containing the larger amount of nitrogen compounds would also be richer in casein, and would, therefore, contain less albumen and albumose in proportion to casein.

#### 11. RELATION OF FAT TO CASEIN IN NORMAL MILK.

Fat and casein are the two constituents in milk that are most essential to the production of cheese, and the amount of these two substances in milk largely determines the yield of cheese. If these two substances are present in milk in proportions that are at all uniform, relative to each other, then either one of them can be used as a factor to ascertain how much cheese should be made from milk. Our work in 1892 and 1893 tended to show that the relation of fat to casein in normal factory milk was a fairly uniform one, and the average for the work of the two seasons showed that usually there would be found in normal factory milk 1.5 pounds of fat for one pound of casein. If this relation is fairly uniform, and if the casein increases relatively in amount when the fat increases, then the fat must be a fairly accurate guide in determining the amount of cheese that can be made from milk.

In addition, our work with different breeds of cows, while showing greater differences than occur between the milk of factory herds, points to the same conclusion, so far as it applies in a practical form to a basis of paying for milk at factories.

Of course, the most critical way of testing the accuracy of the general conclusion is to make application to the milk of individual herds of cows, since it is the milk of separate herds that is considered in paying for milk for cheese-making. Mr. Merry sent samples of the milk of three herds of cows during the season; one herd gave milk highest in fat, and the other two gave milk poorest in fat.

TABLE SHOWING RELATION OF FAT TO CASEIN IN MIXED FACTORY MILK.

DATE.	Per cent. of fat in milk.	Per cent. of casein in milk.	Pounds of fat for one pound of casein.	Pounds of casein for one pound of fat.
1894.				
May 9 .....	3.80	2.37	1.60	0.62
May 16 .....	3.60	2.45	1.47	0.68
May 23 .....	3.60	2.48	1.45	0.69
May 30 .....	3.50	2.45	1.43	0.70
Average for May .....	3.63	2.44	1.49	0.67
June 6 .....	3.60	2.54	1.41	0.70
June 13 .....	3.50	2.33	1.50	0.66
June 20 .....	3.50	2.29	1.53	0.65
June 27 .....	3.60	2.22	1.62	0.62
Average for June .....	3.55	2.35	1.51	0.66
July 4 .....	3.70	2.27	1.63	0.61
July 11 .....	3.55	2.36	1.50	0.66
July 18 .....	3.40	2.19	1.55	0.64
July 25 .....	3.70	2.26	1.64	0.61
Average for July .....	3.59	2.27	1.58	0.63
August 1 .....	3.70	2.31	1.60	0.62
August 15 .....	3.80	2.28	1.67	0.60
August 22 .....	3.80	2.35	1.62	0.62
August 29 .....	3.80	2.35	1.62	0.62
Average for August .....	3.78	2.32	1.63	0.61
September 5 .....	3.80	2.35	1.62	0.62
September 12 .....	3.90	2.25	1.73	0.58
September 19 .....	3.45	2.39	1.44	0.69
September 26 .....	3.85	2.65	1.45	0.69
Average for September .....	3.75	2.41	1.56	0.64
October 3 .....	3.85	2.51	1.53	0.65
October 10 .....	4.00	2.58	1.55	0.64
October 17 .....	4.10	2.64	1.55	0.64
October 24 .....	4.10	2.63	1.56	0.64
October 31 .....	3.90	2.66	1.47	0.68
Average for October .....	4.00	2.60	1.54	0.65

TABLE SHOWING POUNDS OF FAT FOR ONE POUND OF CASEIN IN MILK.

	May.	June.	July.	August.	September.	October.	Average for season.
Least .....	1.43	1.41	1.50	1.60	1.44	1.47	.....
Greatest ..	1.60	1.62	1.64	1.67	1.73	1.56	.....
Average ..	1.49	1.51	1.58	1.63	1.56	1.54	1.55

*a.* For each pound of casein, the fat varied from 1.41 to 1.73 pounds, and averaged 1.55 pounds for the season.

*b.* The relation of fat to casein changed during the drouth in July, August and early September. The fat increased more rapidly in the milk than the casein. After the rain in September, the relation rapidly became normal and more uniform.

TABLE SHOWING RELATION OF FAT TO CASEIN IN THE MILK OF THREE DIFFERENT HERDS OF COWS DURING THE SEASON.

DATE.	HERD GIVING MILK HIGHEST IN FAT.				No. 1 HERD GIVING MILK LOW IN FAT.				No. 2 HERD GIVING MILK LOW IN FAT.			
	Per cent. fat in milk.	Per cent. casein in milk.	Pounds of fat for one pound of casein in milk.	Pounds of fat for one pound of casein in milk.	Per cent. fat in milk.	Per cent. casein in milk.	Pounds of fat for one pound of casein in milk.	Pounds of fat for one pound of casein in milk.	Per cent. fat in milk.	Per cent. casein in milk.	Pounds of fat for one pound of casein in milk.	Pounds of fat for one pound of casein in milk.
1894.												
May 3 .....	4.10	2.25	1.82	0.55	3.20	2.12	1.51	0.66	.....	.....	.....	.....
May 9 .....	4.05	2.63	1.55	0.65	3.30	2.24	1.47	0.68	.....	.....	.....	.....
May 16 .....	3.90	2.68	1.46	0.69	3.25	2.35	1.38	0.72	3.15	2.39	1.32	0.76
May 23 .....	4.30	2.73	1.57	0.64	3.40	2.32	1.47	0.68	3.15	2.42	1.30	0.77
May 30 .....	4.50	2.72	1.65	0.60	3.30	2.24	1.48	0.68	3.35	2.49	1.35	0.74
Average for May .....	4.17	2.60	1.60	0.62	3.29	2.25	1.46	0.68	3.22	2.43	1.33	0.76
June 6 .....	4.30	2.58	1.67	0.60	3.30	2.21	1.49	0.67	3.25	2.51	1.30	0.77
June 13 .....	3.90	2.38	1.64	0.61	3.40	2.06	1.65	0.61	3.10	2.36	1.31	0.76
June 20 .....	4.00	2.48	1.62	0.62	3.30	2.03	1.62	0.62	3.25	2.41	1.35	0.74
June 27 .....	4.10	2.30	1.73	0.56	3.40	1.93	1.76	0.57	3.15	2.22	1.42	0.70
Average for June .....	4.07	2.44	1.67	0.60	3.35	2.06	1.63	0.61	3.19	2.38	1.34	0.75
July 4 .....	4.00	2.43	1.64	0.61	3.30	1.99	1.66	0.60	3.20	2.25	1.42	0.70
July 11 .....	4.55	2.49	1.82	0.55	3.60	2.05	1.75	0.57	3.25	2.25	1.44	0.69

July 18 .....	3.85	2.38	1.62	0.62	3.30	1.99	1.66	0.60	3.00	2.18	1.38	0.73
July 25 .....	4.30	2.54	1.70	0.59	3.40	2.06	1.65	0.61	3.45	2.18	1.58	0.63
Average for July .....	4.18	2.46	1.70	0.59	3.40	2.02	1.68	0.60	3.23	2.22	1.46	0.69
August 1 .....	4.00	2.52	1.59	0.63	3.35	2.03	1.65	0.61	3.40	2.23	1.52	0.66
August 15 .....	4.35	2.56	1.70	0.59	3.60	2.08	1.73	0.58	3.50	2.21	1.58	0.63
August 22 .....	4.00	2.58	1.55	0.65	3.60	2.15	1.67	0.60	3.35	2.53	1.32	0.76
August 29 .....	4.40	2.49	1.77	0.57	3.70	2.07	1.80	0.56	3.55	2.26	1.57	0.64
Average for August .....	4.19	2.54	1.65	0.61	3.56	2.08	1.71	0.59	3.46	2.31	1.50	0.66
September 5 .....	4.00	2.46	1.03	0.62	3.60	2.04	1.76	0.60	3.00	2.26	1.33	0.75
September 12 .....	4.00	2.48	1.61	0.62	3.35	2.05	1.63	0.62	3.00	2.30	1.30	0.77
September 19 .....	3.80	2.78	1.37	0.73	3.00	2.24	1.34	0.75	2.90	2.36	1.23	0.81
September 26 .....	4.50	2.87	1.57	0.64	3.20	2.42	1.32	0.76	3.50	2.61	1.34	0.75
Average for September ..	4.07	2.65	1.54	0.65	3.29	2.19	1.50	0.66	3.13	2.38	1.32	0.76
October 10 .....	4.30	2.72	1.55	0.65	3.75	2.59	1.45	0.69	3.55	2.66	1.33	0.75
October 17 .....	4.70	2.93	1.58	0.64	3.85	2.46	1.57	0.64	3.85	2.61	1.48	0.63
October 24 .....	4.40	2.79	1.58	0.64	3.90	2.42	1.61	0.62	3.90	2.74	1.42	0.70
October 31 .....	4.60	2.91	1.58	0.64	3.55	2.40	1.48	0.63	3.75	3.56	1.47	0.63
Average for October .....	4.50	2.87	1.57	0.64	3.76	2.47	1.52	0.66	3.76	2.64	1.42	0.70

TABLES SHOWING POUNDS OF FAT FOR ONE POUND OF CASEIN IN  
MILK OF DIFFERENT HERDS.

*A — In Milk of Herd Giving Milk Richest in Fat.*

	May.	June.	July.	August.	September.	October.	Average for season.
Least .....	1.46	1.62	1.62	1.55	1.37	1.55	.....
Greatest ..	1.82	1.78	1.82	1.77	1.63	1.58	.....
Average ..	1.60	1.70	1.70	1.65	1.54	1.57	1.61

*B — In Milk of No. 1 Herd Giving Milk Low in Fat.*

	May.	June.	July.	August.	September.	October.	Average for season.
Least .....	1.38	1.49	1.65	1.65	1.32	1.45	.....
Greatest ..	1.51	1.76	1.75	1.80	1.76	1.61	.....
Average...	1.46	1.63	1.68	1.71	1.50	1.52	1.58

*C — In Milk of No. 2 Herd Giving Milk Low in Fat.*

	May.	June.	July.	August.	September.	October.	Average for season.
Least .....	1.30	1.30	1.38	1.32	1.23	1.33	.....
Greatest ..	1.35	1.42	1.58	1.58	1.34	1.48	.....
Average ..	1.33	1.34	1.46	1.50	1.32	1.42	1.40

TABLES SHOWING POUNDS OF CASEIN FOR ONE POUND OF FAT IN  
MILK OF DIFFERENT HERDS.

*A — In Milk of Herd Giving Milk Richest in Fat.*

	May.	June.	July.	August.	September.	October.	Average for season.
Least .....	0.55	0.56	0.55	0.57	0.62	0.64	.....
Greatest ..	0.69	0.62	0.62	0.65	0.73	0.65	.....
Average ..	0.62	0.60	0.59	0.61	0.65	0.64	0.62

*B—In Milk of No. 1 Herd Giving Milk Low in Fat.*

	May.	June.	July.	August.	Septem-ber.	October.	Average for season.
Least .....	0.66	0.57	0.57	0.56	0.60	0.62	.....
Greatest ..	0.72	0.67	0.61	0.61	0.76	0.69	.....
Average ..	0.68	0.61	0.60	0.59	0.66	0.66	0.63

*C—I. Milk of No. 2 Herd Giving Milk Low in Fat.*

	May.	June.	July.	August.	Septem-ber.	October.	Average for season.
Least .....	0.74	0.70	0.63	0.63	0.75	0.68	.....
Greatest ..	0.77	0.77	0.73	0.76	0.81	0.75	.....
Average ..	0.76	0.75	0.69	0.66	0.76	0.70	0.72

The following summary embodies the facts contained in the foregoing tables:

a. The amount of fat in the milk of the herd giving milk richest in fat varied, during the season, from 3.80 to 4.70 per cent., and averaged 4.20 per cent. The amount of casein varied from 2.25 to 2.98 per cent., and averaged 2.60 per cent. For each pound of fat, the amount of casein varied from 0.55 to 0.73 pound, and averaged 0.62 pound.

b. The amount of fat in the milk of No. 1 herd giving milk low in fat varied, during the season, from 3 to 3.90 per cent., and averaged 3.44 per cent. The amount of casein varied from 1.93 to 2.59 per cent., and averaged 2.18 per cent. For each pound of fat, the amount of casein varied from 0.56 to 0.76 pound, and averaged 0.63 pound.

c. The amount of fat in the milk of No. 2 herd giving milk low in fat varied from 2.90 to 3.90 per cent. and averaged 3.33 per cent. during the season. The per cent., of casein varied from 2.18 to 2.74 per cent., and averaged 2.39 per cent. For each pound of fat in milk, the casein varied from 0.63 to 0.81 pound, and averaged 0.72 pound.

d. It will be noticed that the milk of the two herds giving milk low in fat differed in a marked degree in the amount of casein

contained in the milk. The two milks poor in fat, though containing nearly the same amount of fat, differed in their casein content more than did the richest milk and that of No. 1 herd giving milk poor in fat.

e. In order to compare the milk of different herds of cows, it is important that the comparison be continued through an entire season or period of lactation to get entirely reliable results.

## 12. GENERAL SUMMARY OF RESULTS RELATING TO THE COMPOSITION OF NORMAL MILK.

### 1. *Pounds of Solids in 100 Pounds of Milk.*

During the season, the solids in 100 pounds of normal milk varied from 12.29 to 13.39 pounds, and averaged 12.62 pounds.

### 2. *Pounds of Solids not-Fat in 100 Pounds of Milk.*

The amount of solids not fat in 100 pounds of milk varied from 8.61 to 9.29 pounds, and averaged 8.90 pounds during the season.

### 3. *Pounds of Cheese-Producing Solids in 100 Pounds of Milk.*

The amount of cheese-producing solids (fat and casein) in 100 pounds of milk varied from 5.59 to 6.74 pounds, and averaged 6.14 pounds during the season.

### 4. *Pounds of Whey-Solids in 100 Pounds of Milk.*

The amount of whey-solids (albumen, sugar, etc.) in 100 pounds of milk varied from 6.33 to 6.73 pounds, and averaged 6.49 pounds during the season.

### 5. *Pounds of Fat in 100 Pounds of Milk.*

The amount of fat in 100 pounds of milk varied from 3.40 to 4.10 pounds, and averaged 3.73 pounds during the season.

### 6. *Pounds of Nitrogen Compounds in 100 Pounds of Milk.*

The amount of nitrogen compounds in 100 pounds of milk varied from 2.94 to 3.46 pounds, and averaged 3.13 pounds during the season.

7. *Pounds of Casein in 100 Pounds of Milk.*

The amount of casein in 100 pounds of milk varied from 2.19 to 2.66 pounds, and averaged 2.41 pounds during the season.

8. *Pounds of Albumen in 100 Pounds of Milk.*

The amount of albumen in 100 pounds of milk varied from 0.28 to 0.38 pound, and averaged 0.32 pound during the season.

9. *Pounds of Albumose in 100 Pounds of Milk.*

The amount of albumose varied from 0.30 to 0.50 pound, and averaged 0.40 pound in 100 pounds of milk during the season.

10. *Relation of Casein to Albumen and Albumose.*

For each pound of albumen and albumose in milk the casein varied from 2.80 to 4.34 pounds, and averaged 3.35 pounds.

11. *Relation of Fat to Casein in Normal Milk.*

For each pound of fat in milk the casein varied from 0.58 to 0.70 pound, and averaged 0.65 pound.

TABLE SHOWING AVERAGE COMPOSITION OF MILK FOR EACH MONTH OF SEASON.

MONTH.	Pounds of water in 100 lbs. of milk.	Pounds of total solids in 100 lbs. of milk.	Pounds of solids not fat in 100 lbs. of milk.	Pounds of fat in 100 lbs. of milk.	Pounds of nitrogen compounds in 100 lbs. of milk.	Pounds of casein in 100 lbs. of milk.	Pounds of albumen in 100 lbs. of milk.	Pounds of albumose in 100 lbs. of milk.	Pounds of sugar, etc., in 100 lbs. of milk.
1894.									
May .....	87.40	12.60	8.97	3.63	3.14	2.44	0.32	0.38	5.83
June .....	87.53	12.47	8.92	3.55	3.07	2.35	0.29	0.43	5.85
July .....	87.63	12.37	8.78	3.59	3.00	2.27	0.29	0.44	5.78
August.....	87.51	12.49	8.71	3.78	3.05	2.32	0.31	0.42	5.66
September .....	87.33	12.67	8.92	3.75	3.10	2.41	0.34	0.35	5.82
October .....	86.87	13.13	9.13	4.00	3.36	2.60	0.36	0.40	5.77
Average for season .....	87.38	12.62	8.89	3.73	3.13	2.41	0.32	0.40	5.76

## XII. A STUDY OF THE COMPOSITION OF WHEY DURING THE SEASON.

We shall consider the following points in connection with our study of the composition of whey:

1. Pounds of solids in 100 pounds of whey.
2. Pounds of fat in 100 pounds of whey.
3. Pounds of nitrogen compounds in 100 pounds of whey.
4. General summary.

TABLE SHOWING THE COMPOSITION OF WHEY DURING THE SEASON.

DATE.	Per cent. of water.	Per cent. of solids.	Per cent. of solids, not-fat.	Per cent. of fat.	Per cent. of nitro- gen com- pounds.	Per cent. of sugar, ash, etc.
<b>1894.</b>						
May 9.....	93.16	6.84	6.59	0.25	0.83	5.76
May 16.....	93.14	6.86	6.61	0.25	0.80	5.81
May 23.....	93.12	6.88	6.66	0.22	0.83	5.83
May 30.....	93.00	7.00	6.78	0.22	0.84	5.94
Average for May.	93.10	6.90	6.66	0.24	0.83	5.83
June 6 .....	92.86	7.14	6.89	0.25	0.81	6.08
June 13 .....	92.97	7.03	6.79	0.24	0.83	5.96
June 20 .....	93.17	6.83	6.61	0.22	0.79	5.82
June 27 .....	93.05	6.95	6.67	0.28	0.79	5.88
Average for June.	93.01	6.99	6.74	0.25	0.81	5.93
July 4.....	93.17	6.83	6.43	0.40	0.81	5.62
July 11.....	93.13	6.87	6.60	0.27	0.81	5.79
July 18.....	93.17	6.83	6.60	0.23	0.83	5.77
July 25.....	93.16	6.84	6.56	0.28	0.81	5.75
Average for July.	93.16	6.84	6.54	0.30	0.80	5.73
August 1 .....	93.18	6.82	6.56	0.26	0.81	5.75
August 15 .....	93.25	6.75	6.43	0.22	0.82	5.61
August 22 .....	93.20	6.80	6.56	0.24	0.79	5.77
August 29 .....	93.14	6.86	6.51	0.35	0.79	5.72
Average for Aug.	93.19	6.81	6.52	0.29	0.80	5.72
September 5 .....	93.23	6.77	6.47	0.30	0.75	5.72
September 12 .....	93.03	6.97	6.67	0.30	0.79	5.88
September 19 .....	93.19	6.81	6.57	0.24	0.81	5.76
September 26 .....	93.05	6.95	6.65	0.30	0.86	5.79
Average for Sept.	93.12	6.88	6.60	0.28	0.80	5.80

## 1. POUNDS OF SOLIDS IN 100 POUNDS OF WHEY.

	May.	June.	July.	August.	September.	Average for season.
Least .....	6.84	6.83	6.83	6.75	6.77	.....
Greatest .....	7.00	7.14	6.87	6.86	6.97	.....
Average .....	6.90	6.99	6.84	6.81	6.88	6.88

The solids in 100 pounds of whey varied from 6.75 to 7.14 pounds, and averaged 6.88 pounds during the season.

## 2. POUNDS OF FAT IN 100 POUNDS OF WHEY.

	May.	June.	July.	August.	September.	Average for season.
Least .....	0.22	0.22	0.23	0.24	0.24	.....
Greatest .....	0.25	0.28	0.40	0.35	0.30	.....
Average .....	0.24	0.25	0.30	0.29	0.28	0.27

The amount of fat in 100 pounds of whey varied from 0.22 to 0.40 pound, and averaged 0.27 pound during the season.

## 8. POUNDS OF NITROGEN COMPOUNDS IN 100 POUNDS OF WHEY.

	May.	June.	July.	August.	September.	Average for season.
Least .....	0.80	0.79	0.81	0.79	0.75	.....
Greatest .....	0.84	0.83	0.83	0.82	0.86	.....
Average .....	0.83	0.81	0.81	0.80	0.80	0.81

The amount of nitrogen compounds in 100 pounds of milk varied from 0.75 to 0.86 pound, and averaged 0.81 pound during the season.

## 4. GENERAL SUMMARY OF RESULTS RELATING TO THE COMPOSITION OF WHEY.

1. *Pounds of Solids in 100 Pounds of Whey.*

The solids in the whey varied during the season from 6.75 to 7.14 pounds, and averaged 6.88 pounds in 100 pounds of whey.

2. *Pounds of Fat in 100 Pounds of Whey.*

The fat in 100 pounds of whey varied during the season from 0.22 to 0.40 pound, and averaged 0.27 pound.

3. *Pounds of Nitrogen Compounds in 100 Pounds of Whey.*

The amount of nitrogen compounds in 100 pounds of whey varied during the season from 0.75 to 0.86 pound, and averaged 0.81 pound.

4. *Average Composition of Whey for the Season.*

TABLE SHOWING AVERAGE COMPOSITION OF WHEY DURING THE SEASON.

DATE.	Pounds of water in 100 pounds of whey.	Pounds of total solids in 100 pounds of whey.	Pounds of fat in 100 pounds of whey.	Pounds of nitrogen compounds in 100 pounds of whey.	Pounds of sugar, ash, etc., in 100 pounds of whey.
1894.					
May .....	93.10	6.90	0.24	0.83	5.83
June .....	93.01	6.99	0.25	0.81	5.93
July .....	93.16	6.84	0.30	0.81	5.73
August .....	93.19	6.81	0.29	0.80	5.72
September .....	93.12	6.88	0.28	0.80	5.80
Average for season.	93.12	6.88	0.27	0.81	5.80

XIII. A STUDY OF THE COMPOSITION OF GREEN CHEESE DURING THE SEASON.

The following points will be presented in connection with our discussion of the composition of green cheese:

1. Pounds of water in 100 pounds of green cheese.
2. Pounds of solids in 100 pounds of green cheese.
3. Pounds of fat in 100 pounds of green cheese.
4. Pounds of casein, etc., in 100 pounds of green cheese.
5. Relation of fat to casein, etc., in cheese.
6. Relation of fat to solids-not-fat in cheese.
7. General summary.

TABLE SHOWING THE COMPOSITION OF GREEN CHEESE DURING THE SEASON.

DATE	Per cent. of water.	Per cent. of solids.	Per cent. of solids- not-fat.	Per cent. of fat.	Per cent. of casein, etc.	Per cent. of sugar, ash, etc.
1894.						
May 9.....	36.46	63.54	28.16	35.38	23.62	4.54
May 16.....	36.08	63.92	30.52	33.40	24.18	6.34
May 23.....	36.61	63.39	29.92	33.47	23.62	6.30
May 30.....	38.17	61.83	29.44	32.39	23.45	5.99
Average for May.	36.83	63.17	29.51	33.66	23.72	5.79
June 6.....	38.17	61.63	29.58	32.25	23.95	5.63
June 13.....	39.40	60.60	27.20	33.40	24.03	3.17
June 20.....	36.13	63.87	29.71	34.16	23.70	6.01
June 27.....	35.80	64.20	28.82	35.38	23.44	5.38
Average for June.	37.38	62.62	28.83	33.79	23.78	5.05
July 4.....	33.33	66.67	30.77	35.90	23.77	7.00
July 11.....	36.50	63.50	29.48	34.02	24.02	5.46
July 18.....	34.30	65.70	31.50	34.20	23.90	7.60
July 25.....	35.03	64.97	29.11	35.86	23.70	5.40
Average for July.	34.79	65.21	30.21	35.00	23.85	6.36
August 1.....	35.60	64.40	28.28	36.12	23.80	4.48
August 15.....	35.50	64.50	28.68	35.82	23.36	5.32
August 22.....	37.10	62.90	28.48	34.42	23.08	5.40
August 29.....	37.90	62.10	28.44	33.66	22.46	5.98
Average for Aug.	36.53	63.47	28.47	35.00	23.18	5.29
September 5.....	35.10	64.90	29.70	35.20	22.93	6.77
September 12.....	38.56	61.44	27.13	34.31	21.93	5.20
September 19.....	38.32	61.68	30.26	31.42	23.35	6.91
September 26.....	39.73	60.27	28.17	32.10	22.42	5.75
Average for Sept.	37.93	62.07	28.79	33.28	22.66	6.15

1. POUNDS OF WATER IN 100 POUNDS OF GREEN CHEESE.

	May.	June.	July.	August.	Septem-ber.	Average for season.
Least .....	36.08	35.80	33.33	35.50	35.10	.....
Greatest .....	38.17	39.40	36.50	37.90	39.73	.....
Average .....	36.83	37.38	34.79	36.53	37.93	36.70

The amount of water in 100 pounds of cheese varied from 33.33 to 39.73 pounds, and averaged 36.70 pounds during the season.

2. POUNDS OF SOLIDS IN 100 POUNDS OF GREEN CHEESE.

	May.	June.	July.	August.	Septem-ber.	Average for season.
Least .....	61.83	60.60	63.50	62.10	60.27	.....
Greatest .....	63.92	64.20	66.67	64.50	64.90	.....
Average .....	63.17	62.62	65.21	63.47	62.07	63.30

The solids in 100 pounds of green cheese varied from 60.60 to 66.67 pounds, and averaged 63.30 pounds during the season.

3. POUNDS OF FAT IN 100 POUNDS OF GREEN CHEESE.

	May.	June.	July.	August.	Septem-ber.	Average for season.
Least .....	32.39	32.25	34.02	33.66	31.42	.....
Greatest .....	35.38	35.38	35.90	36.12	35.20	.....
Average .....	33.66	33.79	35.00	35.00	33.28	34.18

The amount of fat in 100 pounds of green cheese varied from 31.42 to 36.12 pounds, and averaged 34.18 pounds during the season.

## 4. POUNDS OF CASEIN, ETC., IN 100 POUNDS OF GREEN CHEESE.

	May.	June.	July.	August.	September.	Average for season.
Least.....	23.45	23.44	23.70	22.46	21.93	.....
Greatest.....	24.18	24.03	24.02	23.80	23.35	.....
Average.....	23.72	23.78	23.85	23.18	22.66	23.44

The amount of casein and other nitrogen compounds in 100 pounds of green cheese varied from 21.93 to 23.85 pounds, and averaged 23.44 pounds during the season.

5. RELATION OF FAT TO CASEIN, ETC., IN CHEESE MADE FROM  
NORMAL MILK.

*Table Showing Relation of Fat to Casein in Cheese.*

DATE.	Pounds of fat in 100 pounds of milk.	Pounds of fat in 100 pounds of cheese.	Pounds of casein and other nitrogen compounds in 100 pounds of cheese.	Pounds of fat for one pound of casein, etc., in cheese.
<b>1894.</b>				
May 9.....	3.80	35.38	23.62	1.50
May 16.....	3.60	33.40	24.18	1.39
May 23.....	3.60	33.47	23.62	1.42
May 30.....	3.50	32.39	23.45	1.38
Average for May.	3.63	33.66	23.72	1.42
June 6.....	3.60	33.25	23.95	1.35
June 13.....	3.50	33.40	24.03	1.39
June 20.....	3.50	34.16	23.70	1.44
June 27.....	3.60	35.38	23.44	1.51
Average for June.	3.55	33.79	23.78	1.42
July 4.....	3.70	35.90	23.77	1.51
July 11.....	3.55	34.02	24.02	1.42
July 18.....	3.40	34.30	23.90	1.43
July 25.....	3.70	35.86	23.70	1.51
Average for July.	3.59	35.00	23.85	1.47
August 1.....	3.70	36.12	23.80	1.52
August 15.....	3.80	35.82	23.36	1.53
August 22.....	3.80	34.43	23.08	1.49
August 29.....	3.80	33.66	22.46	1.50
Average for Aug..	3.78	35.00	23.18	1.51
September 5.....	3.80	35.20	22.93	1.53
September 12.....	3.90	34.31	21.93	1.56
September 19.....	3.45	31.42	23.35	1.36
September 26.....	3.85	32.10	22.42	1.43
Average for Sept.	3.75	33.28	22.66	1.47

TABLE, SHOWING POUNDS OF FAT FOR ONE POUND OF CASEIN,  
ETC., IN CHEESE.

	May.	June.	July.	August.	Septem- ber.	Average for season.
Least.....	1.38	1.35	1.42	1.49	1.35	.....
Greatest .....	1.50	1.51	1.51	1.53	1.56	.....
Average .....	1.42	1.42	1.47	1.51	1.47	1.46

For each pound of casein, etc., in the cheese, made from normal milk, the fat varied from 1.35 to 1.56 pounds, and averaged 1.46 pounds during the season.

6. RELATION OF FAT TO TOTAL SOLIDS AND TO SOLIDS-NOT-FAT  
IN CHEESE MADE FROM NORMAL MILK.

*Table Showing Relation of Fat to Solids in Cheese Made from  
Normal Milk.*

DATE.	Pounds of solids in 100 lbs. of cheese.	Pounds of fat in 100 lbs. of cheese.	Pounds of solids- not-fat in 100 lbs. of cheese.	Pounds of fat in 100 lbs. of cheese.	Pounds of solids- not-fat in 100 lbs. of solids in cheese.	Pounds of fat for one pound of solids- not-fat.
1894.						
May 9 .....	63.54	35.38	28.16	55.68	44.32	1.25
May 16 .....	63.92	33.40	30.52	52.25	47.75	1.09
May 23 .....	63.39	33.47	29.92	52.80	47.20	1.12
May 30 ... ..	61.83	32.39	29.44	52.38	47.62	1.10
Average for May.	63.17	33.66	29.51	53.28	46.72	1.14
June 6 .....	61.83	32.25	29.58	52.16	47.84	1.09
June 13 .....	60.60	33.40	27.20	55.12	44.88	1.23
June 20 .....	63.87	34.16	29.71	53.48	46.52	1.15
June 27 .....	64.20	35.38	28.82	55.11	44.89	1.23
Average for June.	62.62	33.79	28.83	53.96	46.04	1.17
July 4.....	66.67	35.90	30.77	53.85	46.15	1.16
July 11.....	63.50	34.02	29.48	53.57	46.43	1.15
July 18.....	65.70	34.20	31.50	52.05	47.95	1.09
July 25.....	64.97	35.86	29.11	55.19	44.81	1.23
Average for July.	65.21	35.00	30.21	53.67	46.33	1.15
August 1 .....	64.40	36.12	28.28	56.09	43.91	1.27
August 15 .....	64.50	35.82	28.68	55.53	44.47	1.25
August 22 .....	62.90	34.42	28.48	54.72	45.28	1.21
August 29 .....	62.10	33.66	28.44	54.20	45.80	1.18
Average for Aug.	63.47	35.00	28.47	55.14	44.86	1.23
September 5.....	64.90	35.20	29.70	54.24	45.76	1.18
September 12.....	61.44	34.31	27.13	55.84	44.16	1.26
September 19.....	61.68	31.42	30.26	50.94	49.06	1.04
September 26.....	60.27	32.10	28.17	53.26	46.74	1.15
Average for Sept.	62.07	33.28	28.79	53.62	46.38	1.15

TABLE SHOWING POUNDS OF FAT IN 100 POUNDS OF SOLIDS IN CHEESE.

	May.	June.	July.	August.	September.	Average for season.
Least.....	52.25	52.16	52.05	54.20	50.94	.....
Greatest.....	55.68	55.12	55.19	56.09	55.34	.....
Average.....	53.28	53.96	53.67	55.14	53.62	54.00

For 100 pounds of solids in the cheese, the amount of fat varied from 50.94 to 56.09 pounds, and averaged 54 pounds during the season. It will be seen that the fat always formed more than one-half of the solids of the cheese.

TABLE SHOWING POUNDS OF SOLIDS-NOT-FAT IN 100 POUNDS OF SOLIDS IN CHEESE.

	May.	June.	July.	August.	September.	Average for season.
Least.....	44.32	44.88	44.81	43.91	44.16	.....
Greatest.....	47.75	47.84	47.95	45.80	49.06	.....
Average.....	46.72	46.04	46.33	44.86	46.38	46.00

The amount of solids-not-fat in 100 pounds of cheese-solids varied from 44.16 to 49.06 pounds, and averaged 46 pounds during the season. In the cheese made from normal milk, the solids-not-fat were never equal to the fat, that is, never formed one-half of the total solids.

TABLE SHOWING POUNDS OF FAT FOR ONE POUND OF SOLIDS-NOT-FAT.

	May.	June.	July.	August.	September.	Average for season.
Least.....	1.09	1.09	1.09	1.18	1.04	.....
Greatest.....	1.25	1.23	1.23	1.27	1.26	.....
Average.....	1.14	1.17	1.15	1.23	1.15	1.17

For every pound of solids-not-fat in cheese, the fat in cheese varied from 1.04 to 1.27 pounds, and averaged 1.17 pounds during the season. It would appear, from the foregoing tables, that in cheese made from normal milk, the fat should always exceed in amount all the other solids of the cheese.

## 7. GENERAL SUMMARY OF RESULTS RELATING TO COMPOSITION OF GREEN CHEESE.

### 1. *Pounds of Water in 100 Pounds of Cheese.*

The water in 100 pounds of green cheese varied from 33.33 to 89.73 pounds, and averaged 36.70 pounds during the season.

### 2. *Pounds of Fat in 100 Pounds of Cheese.*

The fat in 100 pounds of cheese varied from 31.42 to 36.12 pounds, and averaged 34.18 pounds during the season.

### 3. *Pounds of Casein, etc., in 100 Pounds of Cheese.*

The casein and other nitrogen compounds in 100 pounds of cheese varied from 21.93 to 23.85 pounds, and averaged 23.44 pounds during the season.

### 4. *Pounds of Fat for One Pound of Casein in Cheese.*

For each pound of casein, etc., in the cheese, the fat varied from 1.35 to 1.56 pounds, and averaged 1.46 pounds during the season.

### 5. *Pounds of Fat for One Pound of Solids-not-Fat in Cheese.*

For every pound of solids-not-fat in cheese, the fat in the cheese varied from 1.04 to 1.27 pounds, and averaged 1.17 pounds.

### 6. *Average Composition of Green Cheese made from Normal Milk.*

The table following gives the averages of results relating to the composition of green cheese made in the season's work.

TABLE SHOWING AVERAGE COMPOSITION OF GREEN CHEESE FOR THE SEASON OF 1894.

	Pounds of water in 100 pounds of cheese.	Pounds of solids in 100 pounds of cheese.	Pounds of solids- fat, in 100 pounds of cheese.	Pounds of fat in 100 pounds of cheese.	Pounds of casein and other nitro- gen com- pounds in 100 pounds of cheese.	Pounds of sugar, ash, etc., in 100 pounds of cheese.	Pounds of fat for one pound of casein, etc., in cheese.
May.....	36.83	63.17	29.51	33.66	23.72	5.79	1.42
June.....	37.38	62.62	28.83	33.79	23.78	5.05	1.42
July.....	34.79	65.21	30.21	35.00	23.85	6.36	1.47
August.....	36.53	63.47	28.47	35.00	23.18	5.29	1.51
September.....	37.93	62.07	28.79	33.28	23.66	6.15	1.47
Average for season.....	36.70	63.30	29.12	34.18	24.44	4.68	1.46

#### XIV. LOSS OF MILK-CONSTITUENTS IN CHEESE-MAKING.

Under this general head the following topics will be considered:

1. Amount of solids in milk lost and recovered in cheese-making.
2. Amount of fat in milk lost and recovered in cheese-making.
3. Amount of casein and albumen lost and recovered in cheese-making.
4. General summary.

## 1. Amount of Milk-Solids Lost and Recovered in Cheese-making.

TABLE SHOWING AMOUNTS OF MILK-SOLIDS LOST AND RECOVERED IN CHEESE-MAKING.

DATE.	Pounds of fat in 100 pounds of milk.	Pounds of milk-solids in 100 pounds of milk.	Pounds of milk-solids lost in whey for 100 pounds of milk.	Pounds of milk-solids recovered in cheese for 100 pounds of milk.	Per cent. of milk-solids lost in whey.	Per cent. of milk-solids recovered in cheese.	Pounds of milk-solids recovered in cheese for one pound of solids lost in whey.
1894.							
May 9 .....	3.80	12.58	6.15	6.43	48.90	51.10	1.04
May 16 .....	3.60	12.62	6.17	6.45	48.90	51.10	1.04
May 23 .....	3.60	12.62	6.18	6.44	48.97	51.03	1.04
May 30 .....	3.50	12.59	6.29	6.30	49.96	50.04	1.00
Average for May .....	3.63	12.60	6.20	6.40	49.30	50.80	1.08
June 6 .....	3.60	12.87	6.39	6.48	49.65	50.35	1.01
June 13 .....	3.50	12.99	6.34	5.95	51.58	48.42	0.94
June 20 .....	3.50	12.34	6.17	6.17	50.00	50.00	1.00
June 27 .....	3.60	12.37	6.29	6.08	50.85	49.15	0.97
Average for June .....	3.55	12.47	6.30	6.17	50.52	49.48	0.98
July 4 .....	3.70	12.40	6.20	6.20	50.00	50.00	1.00
July 11 .....	3.55	12.36	6.20	6.16	59.16	49.84	0.99
July 18 .....	3.40	12.32	6.19	6.13	50.34	49.76	0.99
July 25 .....	3.70	12.43	6.18	6.25	49.72	50.28	1.01
Average for July .....	3.59	12.37	6.19	6.18	50.04	49.96	1.00

August 1.....	3.70	12.34	6.17	6.17	50.00	50.00	1.00
August 15.....	3.80	12.41	6.09	6.32	49.07	50.93	1.04
August 22.....	3.80	12.63	6.09	6.54	48.22	51.78	1.07
August 29.....	3.80	12.59	6.15	6.44	48.85	51.15	1.05
Average for August.....	3.78	12.49	6.13	6.36	49.08	50.92	1.04
September 5.....	3.80	12.60	6.09	6.51	48.33	51.67	1.07
September 12.....	3.90	12.73	6.23	6.50	48.94	51.06	1.04
September 19.....	3.45	12.45	6.11	6.34	49.08	50.92	1.04
September 26.....	3.85	12.90	6.18	6.72	47.91	52.09	1.09
Average for September.....	3.75	12.67	6.15	6.52	48.54	51.46	1.06

TABLE SHOWING POUNDS OF MILK-SOLIDS IN WHEY MADE FROM 100 POUNDS OF MILK.

	May.	June.	July.	August.	September.	Average for season
Least.....	6.15	6.17	6.18	6.09	6.09	.....
Greatest.....	6.29	6.39	6.20	6.17	6.23	.....
Average.....	6.20	6.30	6.19	6.13	6.15	6.20

The amount of solids in 100 pounds of milk that went into the whey varied from 6.09 to 6.39 pounds, and averaged 6.20 pounds during the season.

TABLE SHOWING PER CENT. OF SOLIDS IN MILK LOST IN WHEY.

	May.	June.	July.	August.	September.	Average for season.
Least.....	48.90	48.65	49.72	48.22	47.91	.....
Greatest.....	48.97	50.85	50.24	50.00	49.08	.....
Average.....	49.20	50.52	50.04	49.08	48.54	49.52

From 47.91 to 50.85 per cent. of the milk-solids went into the whey during the season, the average being 49.52 per cent.

TABLE SHOWING POUNDS OF MILK-SOLIDS RECOVERED IN CHEESE MADE FROM 100 POUNDS OF MILK.

	May.	June.	July.	August.	September.	Average for season.
Least.....	6.30	5.95	6.13	6.17	6.34	.....
Greatest.....	6.45	6.48	6.25	6.54	6.72	.....
Average.....	6.40	6.17	6.18	6.36	6.52	6.32

The amount of solids in 100 pounds of milk that went into cheese varied from 5.95 to 6.62 pounds, and averaged 6.32 pounds.

TABLE SHOWING PER CENT. OF SOLIDS IN MILK RECOVERED IN CHEESE.

	May.	June.	July.	August.	September.	Average for season.
Least.....	50.04	48.42	46.76	50.00	50.92	.....
Greatest.....	51.10	50.80	50.28	51.78	52.09	.....
Average.....	50.80	49.48	49.96	50.92	51.46	50.48

a. The per cent. of solids in the milk recovered in the cheese varied from 48.42 to 52.09, and averaged 50.48 per cent.

2. AMOUNT OF FAT IN MILK LOST AND RECOVERED IN CHEESE-  
MAKING.

*Table Showing Amount of Fat Lost and Recovered in Cheese making.*

DATE.	Pounds of fat in 100 pounds of milk.	Pounds of fat lost in whey for 100 pounds of fat in milk.	Pounds of fat recovered in cheese for 100 pounds of milk.	Per cent. of fat in milk lost in whey.	Per cent. of fat in milk recovered in cheese.
1894.					
May 9 .....	3.80	0.22	3.58	5.79	94.21
May 16 .....	3.60	0.23	3.37	6.39	93.61
May 23 .....	3.80	0.20	3.40	5.55	94.45
May 30 .....	3.50	0.20	3.30	5.71	94.29
Average for May...	3.63	0.21	3.42	5.79	94.21
June 6 .....	3.60	0.22	3.38	6.11	93.89
June 13 .....	3.50	0.22	3.28	6.29	93.71
June 20 .....	3.50	0.20	3.30	5.71	94.29
June 27 .....	3.60	0.25	3.35	6.94	93.06
Average for June...	3.55	0.22	3.33	6.20	93.80
July 4 .....	3.70	0.36	3.34	9.73	90.27
July 11 .....	3.55	0.24	3.31	6.76	93.24
July 18 .....	3.40	0.21	3.19	6.18	93.82
July 25 .....	3.70	0.25	3.45	6.76	93.24
Average for July ..	3.59	0.27	3.32	7.50	92.50
August 1 .....	3.70	0.24	3.46	6.50	93.50
August 15 .....	3.80	0.29	3.51	7.63	92.37
August 22 .....	3.80	0.22	3.58	5.80	94.20
August 29 .....	3.80	0.31	3.49	8.16	91.84
Average for August.	3.78	0.27	3.51	7.14	93.86
September 5 .....	3.80	0.27	3.53	7.10	92.90
September 12 .....	3.90	0.27	3.63	6.92	93.08
September 19 .....	3.45	0.22	3.23	6.38	93.62
September 26 .....	3.85	0.27	3.58	7.00	93.00
Average for Sept...	3.75	0.26	3.49	6.93	93.07

TABLE SHOWING POUNDS OF MILK-FAT LOST IN WHEY FOR 100 POUNDS OF MILK.

	May.	June.	July.	August.	September.	Average for season.
Least .....	0.20	0.20	0.21	0.22	0.22	.....
Greatest.....	0.23	0.25	0.36	0.31	0.27	.....
Average.....	0.21	0.22	0.27	0.27	0.26	0.25

The amount of fat lost in the whey for 100 pounds of milk varied from 0.20 to 0.36 pound, and averaged 0.25 pound during the season.

TABLE SHOWING PER CENT. OF FAT IN MILK LOST IN WHEY.

	May.	June.	July.	August.	September.	Average for season.
Least .....	5.55	5.71	6.18	5.80	6.38	.....
Greatest.....	6.39	6.94	9.73	8.16	7.10	.....
Average.....	5.79	6.20	7.50	7.14	6.93	6.83

The per cent. of fat in the milk that was lost in the whey varied, during the season, from 5.55 to 9.73 per cent., and averaged 6.83 per cent.

TABLE SHOWING POUNDS OF FAT IN MILK RECOVERED IN CHEESE FOR 100 POUNDS OF MILK.

	May.	June.	July.	August.	September.	Average for season.
Least .....	3.30	3.28	3.19	3.46	3.23	.....
Greatest.....	3.58	3.38	3.45	3.58	3.63	.....
Average.....	3.42	3.33	3.32	3.51	3.49	3.41

The amount of fat in 100 pounds of milk that was recovered in the cheese varied from 3.19 to 3.63 pounds, and averaged 3.41 pounds.

TABLE SHOWING PER CENT. OF FAT IN MILK RECOVERED IN CHEESE.

	May.	June.	July.	August.	Septem- ber.	Average for season.
Least.....	93.61	93.06	90.27	91.84	92.90	.....
Greatest.....	94.45	94.29	93.82	94.20	93.62	.....
Average.....	94.21	93.80	92.50	93.86	93.07	93.17

The per cent. of fat in milk recovered in cheese varied from 90.27 to 94.45 per cent, and averaged 93.17 per cent. during the season.

### 3. Amount of Nitrogen Compounds in Milk Lost and Recovered in Cheese-Making.

TABLE SHOWING POUNDS OF NITROGEN COMPOUNDS LOST IN WHEY FOR 100 POUNDS OF MILK.

DATE	Pounds of nitrogen compounds in 100 lbs. of milk.	Pounds of nitrogen compounds lost in whey for 100 lbs. of milk.	Pounds of nitrogen compounds recovered in cheese for 100 lbs. of milk.	Per cent. of nitrogen compounds in milk lost in whey.	Per cent. of nitrogen compounds in milk recovered in cheese.
1894.					
May 9 .....	3.14	0.75	2.39	23.88	76.12
May 16 .....	3.16	0.72	2.44	22.78	77.22
May 23 .....	3.14	0.74	2.40	23.57	76.43
May 30 .....	3.14	0.75	2.39	23.88	76.12
Average for May ..	3.14	0.74	2.40	23.57	76.43
June 6 .....	3.24	0.73	2.51	22.53	77.47
June 13 .....	3.11	0.75	2.36	24.11	75.89
June 20 .....	3.00	0.71	2.29	23.67	76.33
June 27 .....	2.94	0.72	2.22	24.49	75.51
Average for June ..	3.07	0.73	2.34	23.78	76.22
July 4 .....	2.94	0.73	2.21	24.83	75.17
July 11 .....	3.06	0.73	2.33	23.86	76.14
July 18 .....	2.98	0.75	2.23	25.17	74.83
July 25 .....	3.01	0.73	2.28	24.25	75.75
Average for July ..	3.00	0.73	2.27	24.33	75.67
August 1 .....	3.01	0.73	2.28	24.25	75.75
August 15 .....	3.03	0.74	2.29	24.42	75.58
August 22 .....	3.11	0.71	2.40	22.83	77.17
August 29 .....	3.04	0.71	2.33	23.35	76.65
Average for August.	3.05	0.72	2.33	23.60	76.40
September 5 .....	2.98	0.68	2.30	22.82	77.18
September 12 .....	3.03	0.71	2.32	23.43	76.57
September 19 .....	3.13	0.73	2.40	23.32	76.68
September 26 .....	3.26	0.76	2.50	23.31	76.69
Average for Sept. ..	3.10	0.72	2.38	23.22	76.78

TABLE SHOWING POUNDS OF NITROGEN COMPOUNDS LOST IN WHEY FOR 100 POUNDS OF MILK.

	May.	June.	July.	August.	September.	Average for season.
Least .....	0.72	0.71	0.73	0.71	0.68	.....
Greatest .....	0.75	0.75	0.75	0.74	0.76	.....
Average .....	0.74	0.73	0.73	0.72	0.72	0.73

The amount of nitrogen compounds lost in the whey for 100 pounds of milk varied from 0.68 to 0.76 pound, and averaged 0.73 pound during the season.

TABLE SHOWING PER CENT. OF NITROGEN COMPOUNDS IN MILK LOST IN WHEY.

	May.	June.	July.	August.	September.	Average for season.
Least .....	22.78	22.53	23.86	22.83	22.82	.....
Greatest .....	23.88	24.49	25.17	24.42	23.43	.....
Average .....	23.57	23.78	24.33	23.60	23.22	23.78

The per cent. of nitrogen compounds in the milk that was lost in the whey varied from 22.53 to 25.17 per cent., and averaged 23.78 per cent. during the season.

TABLE SHOWING POUNDS OF NITROGEN COMPOUNDS RECOVERED IN CHEESE FOR 100 POUNDS OF MILK.

	May.	June.	July.	August.	September.	Average for season.
Least .....	2.39	2.22	2.21	2.28	2.50	.....
Greatest .....	2.44	2.51	2.33	2.40	2.50	.....
Average .....	2.40	2.34	2.27	2.33	2.38	2.34

The amount of nitrogen compounds recovered in cheese for 100 pounds of milk varied from 2.21 to 2.51 pounds, and averaged 2.34 pounds during the season.

TABLE SHOWING PER CENT. OF NITROGEN COMPOUNDS IN MILK  
RECOVERED IN CHEESE.

	May.	June.	July.	August.	Septem- ber.	Average for season.
Least.....	76.12	75.51	74.83	75.58	76.57	.....
Greatest.....	77.22	77.47	76.14	77.17	77.18	.....
Average.....	76.43	76.22	75.67	76.40	76.78	76.22

a. The per cent. of nitrogen compounds in milk that was recovered in cheese varied from 74.83 to 77.47 per cent., and averaged 76.22 per cent. during the season.

#### 4. General Summary of Results Relating to Loss and Recovery of Milk-Constituents in Cheese-Making.

##### 1. AMOUNT OF SOLIDS IN MILK LOST AND RECOVERED IN CHEESE-MAKING.

a. The milk-solids in 100 pounds of milk varied, during the season, from 12.29 to 12.90 pounds, and averaged 12.52 pounds.

b. Of the solids in 100 pounds of milk there were lost in the whey from 6.09 to 6.39 pounds, with an average of 6.20 pounds; this was equivalent to from 47.91 to 50.85 per cent. of the solids in the milk, with an average of 49.52 per cent.

c. Of the solids in 100 pounds of milk, there were recovered in the cheese from 5.95 to 6.72 pounds, with an average of 6.32 pounds; this was equivalent to from 48.42 to 52.09 per cent. of the solids in the milk, with an average of 50.48 per cent.

d. The per cent. of the solids in milk lost in the whey diminished as the season advanced, while the per cent. of milk-solids recovered in the cheese increased as the season advanced.

##### 2. AMOUNT OF FAT IN MILK LOST AND RECOVERED IN CHEESE-MAKING.

a. The fat in 100 pounds of milk varied, during the season, from 3.40 to 3.90 pounds, and averaged 3.66 pounds.

b. Of the fat in 100 pounds of milk, there were lost in the whey from 0.20 to 0.36 pound, with an average of 0.25 pound, which was equivalent to from 5.55 to 9.73 per cent. of the fat in the milk, with an average of 6.83 per cent.

*c.* Of the fat in 100 pounds of milk, there were recovered in the cheese from 3.19 to 3.63 pounds, with an average of 3.41 pounds, which is equivalent to from 90.27 per cent., to 94.45 per cent., with an average of 93.17 per cent.

*d.* The proportion of milk-fat lost in cheese-making was entirely independent of the amount of fat in the milk. The variations in loss were due either to the condition of the milk or to some special conditions employed in manufacture.

### 3. AMOUNT OF NITROGEN COMPOUNDS IN MILK LOST AND RECOVERED IN CHEESE-MAKING.

*a.* The nitrogen compounds in 100 pounds of milk varied from 2.94 pounds to 3.36 pounds, and averaged 3.07 pounds during the season.

*b.* Of the nitrogen compounds in 100 pounds of milk, there were lost in the whey from 0.68 pound to 0.76 pound, with an average of 0.73 pound, which was equivalent to from 22.53 to 25.17 per cent. of the nitrogen compounds in milk, with an average of 23.78 per cent.

*c.* Of the nitrogen compounds in 100 pounds of milk, there were recovered in the cheese from 2.21 to 2.51 pounds, with an average of 2.34 pounds, which was equivalent to from 74.83 to 77.47 per cent. of the nitrogen compounds in the milk, with an average of 76.22 per cent.

*d.* The proportion of nitrogen compounds lost in cheese-making was, for the most part, very uniform, without regard to conditions of manufacture.

TABLE GIVING GENERAL SUMMARY OF SEASON'S RESULTS RELATING TO LOSS OF MILK-CONSTITUENTS IN CHEESE-MAKING.

	Pounds in 100 pounds of milk.	Pounds lost in whey for 100 pounds of milk.	Pounds re- covered in cheese for 100 pounds of milk.	Per cent. lost in whey.	Per cent. recovered in cheese.
Solids in milk.....	12.52	6.20	6.32	49.52	50.48
Fat in milk.....	3.66	0.25	3.41	6.83	93.17
Nitrogen compounds in milk.....	3.07	0.73	2.34	23.78	76.22

TABLE GIVING SUMMARY OF RESULTS RELATING TO LOSS OF MILK-SOLIDS IN CHEESE-MAKING.

	Pounds of solids in 100 pounds of milk.	Pounds of solids lost in whey for 100 pounds of milk.	Pounds of solids recovered in cheese for 100 pounds of milk.	Per cent. of solids in milk lost in whey.	Per cent. of solids in milk recovered in cheese.
May .....	12.60	6.20	6.40	49.20	50.80
June .....	12.47	6.30	6.17	50.52	49.48
July .....	12.37	6.19	6.18	50.04	49.96
August .....	12.49	6.13	6.36	49.08	50.92
September .....	12.67	6.15	6.52	48.54	51.46
Average for season.	12.52	6.20	6.32	49.52	50.48

TABLE GIVING SUMMARY OF RESULTS RELATING TO LOSS OF MILK-FAT IN CHEESE-MAKING.

	Pounds of fat in 100 pounds of milk.	Pounds of fat lost in whey for 100 pounds of milk.	Pounds of fat recovered in cheese for 100 pounds of milk.	Per cent. of fat in milk lost in whey.	Per cent. of fat in milk recovered in cheese.
May .....	3.63	0.21	3.42	5.79	94.21
June .....	3.55	0.23	3.33	6.20	93.80
July .....	3.59	0.27	3.32	7.50	92.50
August .....	3.78	0.27	3.51	7.14	92.86
September .....	3.75	0.26	3.49	6.93	93.07
Average for season.	3.67	0.25	3.41	6.83	93.17

TABLE GIVING SUMMARY OF RESULTS RELATING TO LOSS OF NITROGEN COMPOUNDS IN CHEESE-MAKING.

	Pounds of nitrogen compounds in 100 lbs. of milk.	Pounds of nitrogen compounds lost in whey for 100 lbs. of milk.	Pounds of nitrogen compounds recovered in cheese for 100 lbs. of milk.	Per cent. of nitrogen compounds in milk lost in whey.	Per cent. of nitrogen compounds in milk recovered in cheese.
May .....	3.14	0.74	2.40	23.57	76.43
June .....	3.07	0.73	2.34	23.78	76.22
July .....	3.00	0.73	2.27	24.33	75.67
August .....	3.05	0.72	2.33	23.60	76.40
September .....	3.10	0.72	2.38	23.22	76.78
Average for season.	3.07	0.73	2.34	23.78	76.22

## XV. RELATION OF COMPOSITION OF MILK TO YIELD OF CHEESE.

Under this head the following points will be considered :

1. Yield of green cheese from 100 pounds of milk.
2. Pounds of milk required to make one pound of green cheese.
3. Amount of water retained in cheese made from 100 pounds of milk.
4. Amount of fat retained in cheese made from 100 pounds of milk.
5. Relation of fat in milk to yield of cheese.

TABLE SHOWING RELATIONS OF MILK CONSTITUENTS TO YIELD OF CHEESE.

DATE.	Pounds of fat in 100 pounds of milk.	Pounds of casein in 100 pounds of milk.	Pounds of green cheese made from 100 pounds of milk.	Pounds of water in cheese made from 100 pounds of milk.	Pounds of fat in cheese made from 100 pounds of milk.	Pounds of nitrogen compounds in cheese made from 100 pounds of milk.	Pounds of ash, etc., in cheese made from 100 pounds of milk.
1894.							
May 9 .....	3.80	2.37	10.13	3.69	3.58	2.39	0.46
May 16 .....	3.60	2.45	10.09	3.64	3.37	2.44	0.64
May 23 .....	3.60	2.48	10.16	3.73	3.40	2.40	0.64
May 30 .....	3.50	2.45	10.19	3.89	3.30	2.39	0.61
Average for May .....	3.63	2.44	10.14	3.74	3.42	2.40	0.58
June 6 .....	3.60	2.54	10.48	4.00	3.38	2.51	0.59
June 13 .....	3.50	2.33	9.82	3.87	3.38	2.36	0.31
June 20 .....	3.50	2.29	9.66	3.49	3.30	2.29	0.58
June 27 .....	3.60	2.22	9.47	3.39	3.35	2.22	0.51
Average for June .....	3.55	2.35	9.86	3.69	3.33	2.34	0.50
July 4 .....	3.70	2.27	9.30	3.10	3.34	2.21	0.65
July 11 .....	3.55	2.36	9.70	3.54	3.31	2.33	0.52
July 18 .....	3.40	2.19	9.33	3.20	3.19	2.28	0.71
July 25 .....	3.70	2.26	9.62	3.37	3.45	2.28	0.52
Average for July .....	3.59	2.27	9.49	3.30	3.32	2.27	0.60

August 1.....	3.70	2.31	9.58	3.41	3.46	2.28	0.43
August 15.....	3.80	2.28	9.80	3.48	3.51	2.29	0.52
August 22.....	3.80	2.35	10.40	3.86	3.58	2.40	0.56
August 29.....	3.80	2.35	10.37	3.93	3.49	2.33	0.62
Average for August.....	3.78	2.32	10.04	3.67	3.51	2.33	0.53
September 5.....	3.80	2.35	10.03	3.52	3.53	2.30	0.68
September 12.....	3.90	2.35	10.58	4.08	3.63	2.32	0.55
September 19.....	3.45	2.39	10.28	3.94	3.23	2.40	0.71
September 26.....	3.85	2.65	11.15	4.43	3.58	2.50	0.64
Average for September.....	3.75	2.41	10.51	3.99	3.49	2.38	0.65

## 1. Yield of Green Cheese.

TABLE SHOWING POUNDS OF MILK REQUIRED TO MAKE ONE P. UND  
OF GREEN CHEESE.

	May.	June.	July.	August.	Septem- ber.	Average for season.
Least .....	9.81	9.54	10.30	9.61	8.97	.....
Greatest .....	9.91	10.56	10.75	10.44	9.97	.....
Average .....	9.86	10.14	10.54	9.96	9.51	10.00

The amount of milk required to make one pound of green cheese varied from 8.97 to 10.75 pounds, and averaged 10 pounds during the season.

As the season advanced, less milk was required to make a pound of cheese, because the per cent. of fat and casein in the milk increased.

TABLE SHOWING POUNDS OF GREEN CHEESE MADE FROM 100 POUNDS  
OF MILK.

	May.	June.	July.	August.	Septem- ber.	Average for season.
Least .....	10.09	9.47	9.30	9.58	10.03	.....
Greatest .....	10.19	10.48	9.70	10.40	11.15	.....
Average .....	10.14	9.86	9.49	10.04	10.51	10.00

During the season, the amount of cheese made from 100 pounds of milk varied from 9.30 to 11.15 pounds and averaged 10 pounds.

2. Amount of Water Retained in Cheese Made from 100  
Pounds of Milk.TABLE SHOWING POUNDS OF WATER RETAINED IN CHEESE MADE  
FROM 100 POUNDS OF MILK.

	May.	June.	July.	August	Septem- ber.	Average for season.
Least .....	3.64	3.39	3.10	3.41	3.43	.....
Greatest .....	3.89	4.00	3.54	3.93	4.08	.....
Average .....	3.74	3.69	3.30	3.67	3.99	3.68

The amount of water retained in the cheese made from 100 pounds of milk varied from 3.10 to 4.05 pounds, and averaged 3.68 pounds during the season.

### 3. Amount of Fat Retained in Cheese made from 100 Pounds of Milk.

TABLE SHOWING POUNDS OF FAT RETAINED IN CHEESE MADE FROM 100 POUNDS OF MILK.

	May.	June.	July.	August.	September.	Average for season.
Least .....	3.30	3.28	3.19	3.46	3.23	.....
Greatest .....	3.58	3.38	3.45	3.58	3.63	.....
Average .....	3.42	3.33	3.32	3.51	3.49	3.41

The amount of fat retained in the cheese made from 100 pounds of milk varied from 3.19 to 3.63 pounds, and averaged 3.41 pounds during the season.

## 4. Relation of Fat in Milk to Yield of Cheese.

TABLE SHOWING POUNDS OF CHEESE MADE FOR ONE POUND OF FAT IN MILK.

DATE.	Pounds of fat in 100 pounds of milk.	Pounds of casein in 100 pounds of milk.	Pounds of green cheese made from 100 pounds of milk.	Pounds of cheese for one pound of fat in milk.	Pounds of cheese calculated for 100 pounds of milk.	Pounds of calculated cheese for one pound of fat in milk.
1894.						
May 9.....	3.80	2.37	10.12	2.67	10.31	2.66
May 16.....	3.60	2.45	10.09	2.80	10.09	2.80
May 23.....	3.60	2.48	10.16	2.85	10.16	2.85
May 30.....	3.50	2.45	10.19	2.90	9.98	2.85
Average for May.	3.63	2.44	10.14	2.79	10.09	2.78
June 6.....	3.60	2.54	10.48	2.91	10.31	2.86
June 13.....	3.40	2.33	9.82	2.80	9.68	2.77
June 20.....	3.50	2.29	9.66	2.76	9.58	2.74
June 27.....	3.60	2.22	9.47	2.63	9.51	2.64
Average for June	3.55	2.35	9.86	2.78	9.78	2.76
July 4.....	3.70	2.27	9.30	2.51	9.75	2.64
July 11.....	3.45	2.36	9.70	2.73	9.80	2.76
July 18.....	3.40	2.19	9.33	2.74	9.22	2.71
July 25.....	3.70	2.26	9.62	2.60	9.72	2.63
Average for July.	3.59	2.27	9.49	2.64	9.62	2.70
August 1.....	3.70	2.31	9.58	2.60	9.84	2.66
August 15.....	3.80	2.28	9.80	2.60	9.88	2.60
August 22.....	3.80	2.35	10.40	2.74	10.06	2.65
August 29.....	3.80	2.35	10.37	2.73	10.06	2.65
Average for Aug	3.78	2.32	10.04	2.66	9.96	2.64
September 5.....	3.80	2.35	10.03	2.64	10.06	2.65
September 12.....	3.90	2.26	10.58	2.71	9.92	2.55
September 19.....	3.45	2.39	10.28	2.98	9.77	2.83
September 26.....	3.85	2.65	11.15	2.90	10.61	2.76
Average for Sept.	3.75	2.41	10.51	2.80	10.15	2.71

**TABULATED SUMMARY SHOWING POUNDS OF CHEESE ACTUALLY  
MADE FOR ONE POUND OF FAT IN MILK.**

	May.	June.	July.	August.	September.	Average for season.
Least.....	2.67	2.63	2.51	2.60	2.64	.....
Greatest.....	2.90	2.91	2.74	2.73	2.98	.....
Average.....	2.79	2.78	2.64	2.66	2.80	2.72

**TABULATED SUMMARY SHOWING POUNDS OF CALCULATED CHEESE  
FOR ONE POUND OF FAT IN MILK.**

	May.	June.	July.	August.	September.	Average for season.
Least.....	2.66	2.64	2.63	2.60	2.55	.....
Greatest.....	2.85	2.86	2.76	2.66	2.83	.....
Average.....	2.78	2.76	2.70	2.64	2.71	2.71

*a.* The amount of cheese actually made for each pound of fat in the milk varied from 2.51 to 2.98 pounds, and averaged 2.72 pounds.

*b.* The average difference between the actual and calculated yield of cheese was 0.01 pound for one pound of milk-fat.

*c.* The average calculated yield of cheese from 100 pounds of milk differed from the actual yield by 0.06 pound, the actual yield being 10 pounds, and the calculated yield 9.94 pounds.

*d.* The variations in individual cases between the actual and calculated yield of cheese was due to the variable amount of water retained in the cheese.

**XVI. THE LOSS OF WEIGHT IN CHEESE.**

Through the co-operation of Mr. F. H. Merry, we are able to present data relating to the loss of weight in cheese between the date of manufacture and sale. As will be seen in the table following, from three to four weeks elapsed between the date of manufacture and sale.

TABLE SHOWING LOSS OF WEIGHT IN CHEESE BETWEEN DATES OF MANUFACTURE AND SALE.

DATE OF MANUFACTURE.	Age of cheese when sold.	Weight of cheese when made.	Weight of cheese when sold.	Loss of weight between dates of manufacture and sale.	Loss of weight for 100 pounds of cheese.	Average daily loss of weight for 100 pounds of cheese.
1894.	Days.	Pounds.	Pounds.	Pounds.	Pounds.	Pounds.
May 3.....	19	741	706	35	4.72	0.25
May 9.....	20	1024	987	37	3.61	0.18
May 16.....	20	1231	1192	39	3.17	0.16
May 23.....	20	1326	1285	41	3.10	0.15
May 30.....	20	1374	1334	40	3.00	0.15
Average for May.	20	1139.2	1100.8	38.4	3.37	0.17
June 6.....	20	1440	1391	49	3.40	0.17
June 13.....	18	1379	1332	47	3.41	0.19
June 20.....	20	1375	1330	45	3.27	0.16
June 27.....	20	1232	1189	43	3.50	0.17
Average for June.	20	1356.5	1310.5	46	3.39	0.17
July 4.....	20	1179	1146	33	2.80	0.14
July 1.....	20	1260	1228	32	2.54	0.13
July 18.....	28	1168	1126	42	3.60	0.13
July 25.....	28	1192	1147	45	3.77	0.16
Average for July.	24	1200	1162	38	3.17	0.14
August 1.....	28	1148	1102	46	4.00	0.14
August 8.....	27	1130	1081	49	4.33	0.16
August 15.....	26	1105	1066	39	3.53	0.14
August 22.....	26	1143	1084	59	5.16	0.19
August 29.....	26	1039	999	40	3.85	0.15
Average for Aug.	26.5	1113	1066.4	46.6	4.19	0.16
September 5.....	20	1019	984	35	3.44	0.17
September 12.....	19	955	928	27	2.83	0.15
September 19.....	20	985	955	30	3.05	0.15
September 26.....	20	964	947	17	1.80	0.09
Average for Sept.	20	980.75	953.5	27.25	2.78	0.14
October 3.....	20	968	940	28	2.90	0.14

TABLE SHOWING SUMMARY OF LOSS OF WEIGHT FOR 100 POUNDS OF CHEESE.

	May.	June.	July.	August.	September.	Average for season.
	Pounds.	Pounds.	Pounds.	Pounds.	Pounds.	Pounds.
Least .....	3.00	3.27	2.54	3.53	1.80	.....
Greatest.....	4.72	3.50	3.77	5.16	3.44	.....
Average.....	3.37	3.39	3.17	4.19	2.78	3.40

a. The loss of weight for 100 pounds of cheese between dates of manufacture and sale varied from 1.80 to 5.16 pounds, and averaged 3.40 pounds for the season.

b. The loss was greatest in August and least in September.

c. The number of days between manufacture and sale of cheese varied from 18 to 28, and averaged  $26\frac{1}{2}$  days.

TABLE SHOWING SUMMARY OF AVERAGE DAILY LOSS OF WEIGHT FOR 100 POUNDS OF CHEESE.

	May.	June.	July.	August.	September.	Average for season.
	Pounds.	Pounds.	Pounds.	Pounds.	Pounds.	Pounds.
Least .....	0.15	0.16	0.13	0.14	0.09	.....
Greatest.....	0.25	0.19	0.16	0.19	0.17	.....
Average.....	0.17	0.17	0.14	0.16	0.14	0.155

a. The average daily loss of weight for 100 pounds of cheese between dates of manufacture and sale varied from 0.09 to 0.25 pound, and averaged, for the season, 0.155 pound, which is equivalent to two and one-half ounces.

b. The average daily loss was quite uniform, whether the cheese was kept three or four weeks.

## XVII. GENERAL SUMMARY OF THE SEASON'S RESULTS OF CHEESE INVESTIGATION.

### 1. EXTENT OF INVESTIGATION.

#### 1. *Amount of Work Done.*

Samples of mixed milk, etc., were received and analyzed once each week during 22 weeks from May to October; and five samples of mixed milk were received during October; in addition, 78 samples of milk from the best and poorest herds were received.

#### 2. *Amount of Milk Used and Cheese Made.*

The amount of milk actually handled on the days when work was done aggregated 256,589 pounds, which represented the average of not less than 1,500,000 pounds, the daily yield of milk varying from 8,643 to 14,232 pounds. The amount of cheese actually made on the 22 special days aggregated 25,640 pounds. There were 650 cows, consisting largely of natives, with some Ayrshire and Holstein grades.

### 2. CONDITIONS OF MANUFACTURE.

#### 1. *Amount of Rennet-Extract Used.*

The amount of rennet-extract used for 1,000 pounds of milk varied from three and one-half to four and one-half ounces, and averaged three and three-quarters ounces.

#### 2. *Temperature of Milk when Rennet was Added.*

The temperature of the milk when the rennet was added varied from 83° to 86° F., and averaged about 84° F.

#### 3. *Time Required for Rennet to Coagulate Milk.*

The time of coagulation varied from 25 to 45 minutes, and averaged over 35 minutes.

#### 4. *Temperature to which Curd was Heated.*

The degree of temperature to which the curd was heated after cutting varied from 99° to 101° F., and averaged 100° F.

5. *Time from Cutting Curd to Drawing Whey.*

The time that passed between cutting the curd and drawing the whey varied from 2 hours and 35 minutes, to 5 hours and averaged 3 hours and 43 minutes.

6. *Length of String on Hot Iron when Whey was Drawn.*

The length of string formed on a hot iron when whey was drawn varied from one-eighth to one-half of one inch.

7. *Time from Drawing Whey to Putting in Press.*

The time that passed between drawing the whey and putting the curd in press varied from 1 hour and 15 minutes to nearly 2 hours and 50 minutes and averaged about 1 hour and 50 minutes.

8. *Length of String on Hot Iron when Curd was put in Press.*

The string varied in length from one and a half to two inches and averaged about one and a half inches.

9. *Temperature of Curd when put in Press.*

The temperature of the curd when put in press varied from 83° to 87° F. and averaged about 85° F.

10. *Time occupied by Operation of Cheese-making after adding Rennet.*

The time occupied by the operation of cheese-making after adding the rennet varied from 4 hours to 7 hours and 15 minutes and averaged 6 hours and 16 minutes.

3. THE COMPOSITION OF NORMAL MILK.

1. *Pounds of Solids in 100 Pounds of Milk.*

The milk-solids in 100 pounds of milk varied during the season from 12.29 to 13.39 pounds, and averaged 12.62 pounds.

2. *Pounds of Solids-not-Fat in 100 Pounds of Milk.*

The amount of milk-solids, exclusive of the fat (including casein, albumen, sugar, ash, etc.), varied from 8.61 to 9.29 pounds, and averaged 8.90 pounds during the season.

3. *Pounds of Cheese-Producing Solids (Fat and Casein) in 100 Pounds of Milk.*

The amount of cheese-producing solids (fat and casein) in 100 pounds of milk varied from 5.59 to 6.74 pounds, and averaged 6.14 pounds during the season.

4. *Pounds of Whey-Solids (Albumen, Sugar, Ash, etc.) in 100 Pounds of Milk.*

The amount of whey-solids (albumen, sugar, etc.) in 100 pounds of milk varied from 6.33 to 6.73 pounds, and averaged 6.49 pounds during the season.

5. *Pounds of Fat in 100 Pounds of Milk.*

The fat in 100 pounds of milk varied during the season from 3.40 to 4.10 pounds, and averaged 3.73 pounds.

6. *Pounds of Nitrogen Compounds in 100 Pounds of Milk.*

The nitrogen compounds in 100 pounds of milk varied during the season from 2.94 to 3.46 pounds, and averaged 3.13 pounds.

7. *Pounds of Casein in 100 Pounds of Milk.*

The casein in 100 pounds of milk varied during the season from 2.19 to 2.66 pounds, and averaged 2.41 pounds.

8. *Pounds of Albumen in 100 Pounds of Milk.*

The albumen in 100 pounds of milk varied during the season from 0.28 to 0.38 pound, and averaged 0.32 pound.

9. *Pounds of Albumose in 100 Pounds of Milk.*

The amount of albumose in 100 pounds of milk varied from 0.30 to 0.50 pound, and averaged 0.40 pound during the season.

10. *Relation of Casein to Albumen and Albumose in Milk.*

For each pound of albumen and albumose the casein varied from 2.80 to 4.34 pounds, and averaged 3.35 pounds during the season.

11. *Relation of Fat to Casein in Normal Milk.*

For each pound of fat the casein varied from 0.58 to 0.70 pound, and averaged 0.65 pound during the season.

4. THE COMPOSITION OF WHEY.

1. *Pounds of Solids in 100 Pounds of Whey.*

The amount of solids in 100 pounds of whey varied during the season from 6.75 to 7.14 pounds, and averaged 6.88 pounds.

2. *Pounds of Fat in 100 Pounds of Whey.*

The amount of fat in 100 pounds of whey varied during the season from 0.22 to 0.40 pound, and averaged 0.27 pound.

3. *Pounds of Nitrogen Compounds in 100 Pounds of Whey.*

The amount of nitrogen compounds in 100 pounds of whey varied during the season from 0.75 to 0.86 pound, and averaged 0.81 pound.

5. THE COMPOSITION OF GREEN CHEESE MADE FROM NORMAL MILK.

1. *Pounds of Water in 100 Pounds of Green Cheese.*

The amount of water in 100 pounds of green cheese varied during the season from 33.33 to 39.73 pounds, and averaged 36.70 pounds.

2. *Pounds of Solids in 100 Pounds of Cheese.*

The amount of solids in 100 pounds of green cheese varied from 60.27 to 66.67 pounds, and averaged 63.30 pounds during the season.

3. *Pounds of Fat in 100 Pounds of Green Cheese.*

The amount of fat in 100 pounds of green cheese varied during the season from 31.42 to 36.12 pounds, and averaged 34.18 pounds.

4. *Pounds of Casein, etc., in 100 Pounds of Green Cheese.*

The amount of casein, etc., in 100 pounds of green cheese varied during the season from 21.93 to 23.85 pounds, and averaged 23.44 pounds.

5. *Relation of Fat to Casein, etc., in Cheese made from Normal Milk.*

For each pound of casein, etc., in the cheese, the fat varied from 1.35 to 1.56 pounds, and averaged 1.46 pounds during the season.

6. *Relation of Fat to Solids-not-Fat in Cheese.*

For each pound of solids-not-fat, the fat varied from 1.04 to 1.27 pounds, and averaged 1.17 pounds during the season.

6. LOSS OF MILK-CONSTITUENTS IN CHEESE MAKING.

1. *Loss of Milk-Solids in Cheese-making.*

a. The amount of milk-solids in 100 pounds of milk that was lost in the whey in cheese-making varied during the season from 6.09 to 6.39 pounds, and averaged 6.20 pounds; this was equivalent to from 47.91 to 50.85 per cent. of the solids in the milk, with an average of 49.52 per cent.

b. The per cent. of the solids in the milk lost in the whey diminished as the season advanced.

2. *Loss of Fat in Cheese-making.*

a. The amount of fat in 100 pounds of milk that was lost in the whey in cheese-making varied during the season from 0.20 to 0.36 pound, and averaged 0.25 pound; this was equivalent to from 5.55 to 9.73 per cent. of the fat in the milk, with an average of 6.83 per cent.

b. The proportion of fat in milk that was lost in cheese-making was entirely independent of the amount of fat in the milk. The variations in loss were due either to the condition of the milk or to some special conditions employed in manufacture.

3. *Loss of Nitrogen Compounds in Cheese-making.*

a. The amount of nitrogen compounds in 100 pounds of milk that was lost in the whey in cheese-making varied during the season from 0.68 to 0.76 pound, and averaged 0.73 pound; this was equivalent to from 22.53 to 25.17 per cent. of the nitrogen compounds in the milk, with an average of 23.78 per cent.

b. The proportion of nitrogen compounds lost in cheese-making was, in general, very uniform and was influenced by variation in the conditions of manufacture.

## 7. INFLUENCE OF COMPOSITION OF MILK ON YIELD OF CHEESE.

1. *Yield of Green Cheese from 100 Pounds of Milk.*

From 100 pounds of milk there were made during the season from 9.30 to 11.15 pounds of green cheese, the average being 10 pounds.

2. *Pounds of Milk Required to Make One Pound of Cheese.*

From 8.97 to 10.75 pounds of milk were required to make one pound of cheese, 10 pounds being the average.

3. *Amount of Water Retained in Cheese made from 100 Pounds of Milk.*

The amount of water retained in the cheese made from 100 pounds of milk varied during the season from 3.10 to 4.08 pounds, and averaged 3.68 pounds.

4. *Amount of Fat Retained in Cheese made from 100 Pounds of Milk.*

The amount of fat retained in the cheese made from 100 pounds of milk varied during the season from 3.19 to 3.63 pounds, and averaged 3.41 pounds. The variation in the amount of fat retained in the cheese made from 100 pounds of milk followed very closely the variation of fat in 100 pounds of milk.

5. *Amount of Casein, etc., Retained in Cheese made from 100 Pounds of Milk.*

The amount of casein, etc., retained in the cheese made from 100 pounds of milk varied during the season from 2.21 to 2.51 pounds, and averaged 2.34 pounds.

6. *Relation of Fat in Milk to Yield of Green Cheese.*

Each pound of fat produced from 2.51 to 2.98 pounds of cheese, the average for the season being 2.72 pounds.

## 8. LOSS OF WEIGHT IN CHEESE.

1. *Loss of Weight of 100 Pounds of Cheese.*

The loss of weight for 100 pounds of cheese between dates of manufacture and sale varied from 1.80 to 5.16 pounds, and averaged 3.40 pounds for the season.

### 2. *Time between Manufacture and Sale of Cheese.*

The number of days between manufacture and sale of cheese varied from 18 to 28, and averaged  $26\frac{1}{2}$  days.

### 3. *Average Daily Loss.*

The average daily loss of weight for 100 pounds of cheese varied from 0.09 to 0.25 pound, and averaged, for the season, 0.155 pound, which is equivalent to  $2\frac{1}{2}$  ounces. The average daily loss was quite uniform, whether cheese was kept three weeks or four weeks.

## 9. TABULATED SUMMARY OF RESULTS.

### 1. *Composition of Milk.*

	IN 100 POUNDS OF MILK.		
	Least.	Greatest.	Average.
	Pounds.	Pounds.	Pounds.
Water .....	86.61	87.71	87.38
Total solids .....	12.29	13.39	12.62
Fat .....	3.70	4.10	3.73
Nitrogen compounds .....	2.94	3.46	3.13
Casein .....	2.19	2.66	2.41
Albumen and albumose .....	0.58	0.88	0.72
Sugar, ash, etc. ....	5.58	6.03	5.72
Pounds of casein for one pound of albumen and albumose .....	2.80	4.34	3.35
Pounds of fat for one pound of casein ....	1.41	1.73	1.55
Pounds of casein for one pound of fat ....	0.58	0.70	0.65

### 2. *Composition of Whey.*

	IN 100 POUNDS OF WHEY.		
	Least.	Greatest.	Average.
	Pounds.	Pounds.	Pounds.
Water .....	92.86	93.25	93.12
Total solids .....	6.75	7.14	6.88
Fat .....	0.22	0.40	0.27
Nitrogen compounds .....	0.75	0.86	0.81
Sugar, ash, etc. ....	5.61	6.08	5.80

3. *Composition of Green Cheese.*

	IN 100 POUNDS OF GREEN CHEESE.		
	Least.	Greatest.	Average.
	Pounds.	Pounds.	Pounds.
Water .....	33.33	39.73	36.70
Total solids .....	60.27	66.67	63.30
Fat .....	31.42	36.12	34.18
Casein, etc .....	21.93	23.85	23.44
Sugar, ash, etc .....	3.17	7.60	5.68
Pounds of fat for one pound of casein....	1.35	1.56	1.46
Pounds of fat for one pound of solids-not-fat	1.04	1.27	1.17

4. *Amount of Milk-Constituents Lost in Cheese-Making.*

	LOST IN WHEY FOR 100 POUNDS OF MILK.		
	Least.	Greatest.	Average.
	Pounds.	Pounds.	Pounds.
Water .....	82.53	84.61	83.70
Total solids .....	6.09	6.39	6.20
Fat .....	0.20	0.36	0.25
Nitrogen compounds .....	0.68	0.76	0.73
Sugar, ash, etc .....	5.06	5.44	5.22

5. *Amount of Milk-Constituents Recovered in Cheese-Making.*

	RETAINED IN CHEESE FOR 100 POUNDS OF MILK.		
	Least.	Greatest.	Average.
	Pounds.	Pounds.	Pounds.
Water .....	3.10	4.08	3.68
Total solids .....	5.95	6.72	6.32
Fat .....	3.19	3.63	3.41
Nitrogen compounds .....	2.21	2.51	2.34

6. *Yield of Cheese and Whey.*

	Least.	Greatest.	Average.
	Pounds.	Pounds.	Pounds.
Green cheese from 100 pounds of milk...	9.30	11.15	10.00
Pounds of milk for one pound of green cheese .....	8.97	10.75	10.00
Pounds of whey for 100 pounds of milk..	88.85	91.70	90.00
Pounds of green cheese for one pound of fat in milk .....	2.51	2.98	2.72

## XVIII. THE DETERMINATION OF ALBUMEN IN COWS' MILK.

In the last annual report the writer presented a paper on the determination of casein in cows' milk. It is now desired to present another paper supplementary to that and relating to the determination of albumen in cows' milk.

Ordinarily, when we speak of milk albumen we mean the portion of nitrogen compounds not coagulated by rennet, acid, etc. In other words, we apply the term albumen to the nitrogen compounds left after removing the casein proper. This use of the term albumen is inaccurate, because, after removing from normal milk its casein, there remain, at least, two nitrogen compounds or classes of nitrogen compounds. One of these is coagulated by heat, especially in the presence of dilute acids, while the other is not coagulated under these conditions. To the former only of these two the term albumen is properly applicable.

## DETAILS OF METHOD.

The filtrate obtained, after separating the casein by the method described in the article above referred to, is placed in a water-bath heated to the boiling temperature of water, the breaker containing the filtrate being covered with a watch-glass crystal. The solution is kept at this temperature until the albumen coagulates and settles to the bottom, leaving the supernatant liquid clear. Ten or fifteen minutes usually suffices to accomplish this.

The precipitate is filtered, washed and then treated according to the Kjeldahl method for determining nitrogen. The amount of nitrogen multiplied by the factor 6.25 gives the amount of albumen.

It was thought that too long boiling of the albumen precipitate might cause some of it to redissolve; and, in order to ascertain what effect the length of time of heating influenced the results, the digestion was varied from 5 minutes to 10 hours. The tabulated results are as follows:

NUMBER OF SAMPLE OF MILK.		LENGTH OF TIME SOLUTION CONTAINING ALBUMEN WAS HEATED — PER CENT OF NITROGEN IN ALBUMEN CONTAINED IN MILK.									
		5 Minutes.	10 minutes.	15 minutes.	20 minutes.	30 minutes.	45 minutes.	1 hour.	2 hours.	4 hours.	10 hours.
1.....	a	0.060	0.057	0.054	0.056	0.057	0.061	0.046	0.060		
	b	0.062	0.048	0.051	0.063	0.059	0.051	0.045	0.055		
Average .....		0.061	0.053	0.053	0.059	0.051	0.049	0.047	0.051	0.051	0.057
2.....	a	0.014	0.054	0.052	0.051	0.052	0.051	0.047	0.045	.....	.....
	b	0.044	0.053	0.054	0.051	0.051	0.051	0.051	0.049	0.049	.....
Average .....		0.029	0.053	0.054	0.052	0.051	0.051	0.049	0.047	0.047	.....
3.....	a	0.054	0.053	0.049	0.052	0.051	0.053	0.057	0.056	0.058	
	b	0.054	0.047	0.053	0.046	.....	0.057	0.057	0.053	0.055	
Average .....		0.054	0.050	0.051	0.054	0.051	0.055	0.057	0.055	0.055	
4.....	a	0.057	0.064	0.061	0.065	0.065	0.065	0.062	0.069	0.065	
	b	0.062	0.055	0.065	0.063	0.064	0.062	0.065	0.066	.....	
Average .....		0.059	0.060	0.063	0.062	0.064	0.063	0.063	0.064	0.069	0.065
Average of all results.....		0.047	0.056	0.056	0.055	0.055	0.057	0.057	0.058	0.056	0.059

An examination of the foregoing tables shows:

1. In one case, heating for five minutes gave low results; in two other cases, good results.

2. In general, the results varied little with increased length of time of heating.

3. There was a slight tendency to higher results with increased length of heating, but such increase was more or less irregular and, at most, amounted to only 0.002 or 0.003 per cent. of nitrogen.

4. It would, therefore, appear that entirely satisfactory results can be obtained by heating the solution containing albumen under the given conditions for 10 or 15 minutes, while an increased length of time of heating does not practically change the results.

It may be stated that the precipitate formed always filters readily and washes easily.

#### SEPARATION AND DETERMINATION OF THE NITROGEN COMPOUNDS OF COWS' MILK.

Below we give a brief summary of our method as we employ it in effecting the determination and separation of the three classes of nitrogen compounds present in the normal milk of cows.

1. *Total nitrogen compounds*.—Determine the amount of total nitrogen by the Kjeldahl method and multiply by the factor 6.25.

2. *Casein*.—Weigh out about ten grams of milk, dilute in a beaker with about 90 cc. of water at 40°–42° C., and add at once 1.5 cc. of a solution containing 10 per cent. of acetic acid, by weight. Stir with a glass rod and let stand three to five minutes longer. Then decant on a filter, wash two or three times with cold water by decantation and then transfer precipitate completely to filter. Wash once or twice on filter. The washed precipitate and filter paper are then digested as in the regular Kjeldahl method for the determination of nitrogen, and the determination completed in the usual manner. To calculate the nitrogen into an equivalent amount of casein, multiply the amount of nitrogen by the factor 6.25.

3. *Albumen*.—The filtrate obtained above in separating casein is placed in a water-bath and heated to the boiling temperature of water for 10 or 15 minutes. The filtered and washed pre-

precipitate is then treated by the Kjeldahl method for determining nitrogen. The amount of nitrogen multiplied by 6.25 gives the amount of albumen.

4. *Remaining nitrogen compounds.* — The remaining compound or compounds of nitrogen are determined by difference, subtracting from the amount of total nitrogen compounds the sum of the casein and albumen.

In conclusion, I wish to call attention to the crude nomenclature in common use in stating the results of milk analysis for nitrogen compounds. It is an almost universal custom to call the total nitrogen compounds of milk casein. It would be quite as correct to call the fat of milk palmitin or some similar name. This wrong use of the term casein leads to much confusion, and it is highly desirable that we should use a more discriminating nomenclature. It is also desirable that, in making analysis of milk, pains should be taken to separate and determine the different kinds of nitrogen compounds, since our knowledge of these compounds is far from complete.

#### TRADE VALUES OF FERTILIZING INGREDIENTS IN RAW MATERIALS AND CHEMICALS, ADOPTED BY EXPERIMENT STATIONS.

	Per pound for 1894.
Nitrogen in ammonia salts.....	\$0 19
Nitrogen in nitrates.....	14½
Organic nitrogen in dry and fine ground fish, meat and blood, and in high grade mixed fertilizers .....	18½
Organic nitrogen in cotton-seed meal and castor-pomace..	15
Organic nitrogen in fine ground bone and tankage .....	16½
Organic nitrogen in fine ground medium bone and tankage	15
Organic nitrogen in medium bone and tankage.....	12
Organic nitrogen in coarse bone and tankage .....	7
Organic nitrogen in hair, horn shavings and coarse fish scraps .....	7
Phosphoric acid, soluble in water .....	6
Phosphoric acid, soluble in ammonium citrate.....	5½
Phosphoric acid in fine bone and tankage.....	5½
Phosphoric acid in fine medium bone and tankage.....	4½

	Per pound for 1894.
Phosphoric acid in medium bone and tankage . . . . .	\$0 3
Phosphoric acid in coarse bone and tankage . . . . .	2
Phosphoric acid in fine ground fish, cotton-seed meal, castor-pomace and wood ashes . . . . .	5
Phosphoric acid, insoluble in ammonium citrate, in mixed fertilizers . . . . .	2
Potash as high-grade sulphate, in forms free from muri- ates (chlorid's) in ashes, etc . . . . .	5
Potash in muriate . . . . .	<u>4½</u>

### VALUATION OF FERTILIZING INGREDIENTS IN FOODS.

	Per pound for 1894.
Organic nitrogen . . . . .	\$0 15
Phosphoric acid . . . . .	5
Potash . . . . .	<u>5</u>

XX. RESULTS OF ANALYSES OF COMMERCIAL FERTILIZERS.  
*Composition of fertilizers as guaranteed by manufacturers, and*

MANUFACTURER.	Trade name or brand.	Locality where sample was taken.	Station number.
Acme Fertilizer Co., Maspeth, L. I.	Acme fertilizer No. 1.	Flatlands, Jamaica.	1473 1514
Acme Fertilizer Co., Maspeth, L. I.	Acme fertilizer No. 2.	Flatbush Jamaica.	1474 1510
Acme Fertilizer Co., Maspeth, L. I.	Potato fertilizer.	Bridgehampton.	1585
Acme Fertilizer Co., Maspeth, L. I.	Superior superphosphate.	Bridgehampton.	1586
J. H. Baker & Bro., New York city.	A A ammoniated superphosphate.	Southold.	1546
J. H. Baker & Bro., New York city.	Complete cabbage manure.	Flatlands, Jamaica.	1482 1509
J. H. Baker & Bro., New York city.	Complete oat manure.	Cutchogue.	1594
J. H. Baker & Bro., New York city.	Complete potato manure.	Parkville, Jamaica.	1468 1508
J. H. Baker & Bro., New York city.	Victor special fertilizer.	Cutchogue.	1583
Bowker Fertilizer Co., Boston, Mass.	Ammoniated dissolved bone.	Rochester.	1455
Bowker Fertilizer Co., Boston, Mass.	Carpenter's special fertilizer for peas and beans.	Jamaica.	1496
Bowker Fertilizer Co., Boston, Mass.	Carpenter's special fertilizer for potatoes.	Jamaica.	1497
Bowker Fertilizer Co., Boston, Mass.	G. & T. high grade potato manure.	Riverhead.	1563
Bowker Fertilizer Co., Boston, Mass.	Hill and drill.	Rochester.	1466
Bowker Fertilizer Co., Boston, Mass.	Kainit.	Riverhead.	1544

ZERS IN NEW YORK STATE FOR THE SPRING OF 1894.

as found by chemical analysis. Expressed in parts per hundred.

	NITROGEN.		PHOSPHORIC ACID.			Potash soluble in water. Expressed as actual potash.
	Expressed as nitrogen.	Equivalent to ammonia	Available.	Insoluble	Total.	
Guaranteed. Found.	3.7 to 4.1 2.16	4.5 to 5 3.64	8 to 9 8.1	..... 1.47	..... 9.57	9 to 10 8.5
Guaranteed. Found.	4.95 to 5.35 4.35	6 to 6.5 5.27	8 to 9 6.77	..... 2.22	..... 8.99	5 to 6 5.56
Guaranteed. Found.	2.9 to 3.3 2.55	3.5 to 4 3.1	7 to 8 7.34	..... 1.77	..... 9.11	9 to 10 9.15
Guaranteed. Found.	1.25 to 1.65 1.16	1.5 to 2 1.69	8 to 10 7.69	..... 2.71	..... 10.4	4 to 5 4.35
Guaranteed. Found.	2.5 to 3.3 3.02	3 to 4 3.67	10 to 12 10.37	..... 2.2	..... 12.47	2 to 3 2.88
Guaranteed. Found.	4.7 5.13	5.75 6.22	5 4.97	..... 2.69	..... 7.66	7 6.9
Guaranteed. Found.	4.1 4.33	5 5.25	5 5.3	..... 2.09	..... 7.39	9 9.22
Guaranteed. Found.	3.3 4.36	4 5.29	5.75 5.77	..... 2.4	..... 8.17	10 10.77
Guaranteed. Found.	3.3 3.28	4 3.98	10 9.37	..... 3.55	..... 12.92	8 6.78
Guaranteed. Found.	1.65 to 2.5 1.52	2 to 3 1.85	8 to 10 9.79	..... 1.19	10 to 12 10.98	2 to 3 1.5
Guaranteed. Found.	2.5 to 3.3 2.39	3 to 4 2.78	8 to 10 10.29	..... 1.98	10 to 12 12.21	2 to 4 1.98
Guaranteed. Found.	3.7 to 4.5 3.54	4.5 to 5.5 4.29	7 to 9 9.4	..... 1.07	..... 10.47	6.5 to 7.5 7
Guaranteed. Found.	3.3 to 4.1 2.62	4 to 5 3.18	7 to 9 10.38	..... 1.45	9 to 11 11.83	7 to 9 5.93
Guaranteed. Found.	2.05 to 2.9 2.21	2.5 to 3.5 2.68	8 to 10 7.79	..... 2.9	10 to 12 11.69	2 to 3 2.17
Guaranteed. Found.	.....	.....	.....	.....	.....	11 to 13 12.22

## XX. RESULTS OF ANALYSES OF COMMERCIAL FERTILIZERS IN

MANUFACTURER.	Trade name or brand.	Locality where sample was taken.	Station number.
Bowker Fertilizer Co., Boston, Mass.	Potato manure.	Rochester.	1454
Bowker Fertilizer Co., Boston, Mass.	Potato phosphate.	Rochester.	1457
Bowker Fertilizer Co., Boston, Mass.	Potato and vegetable manure.	Rochester. Cutchogue.	1458 1596
Bowker Fertilizer Co., Boston, Mass.	Stockbridge cabbage and cauliflower manure.	Jamaica.	1498
Bowker Fertilizer Co., Boston, Mass.	Stockbridge potato and vegetable manure	Southold.	1551
Bowker Fertilizer Co., Boston, Mass.	Stockbridge celery manure.	Rochester.	1451
Bowker Fertilizer Co., Boston, Mass.	Stockbridge onion manure.	Rochester.	1452
Bowker Fertilizer Co., Boston, Mass.	Stockbridge potato manure.	Rochester.	1453
Bowker Fertilizer Co., Boston, Mass.	Stockbridge potato and vegetable manure.	Jamaica.	1499
Bowker Fertilizer Co., Boston, Mass.	Stockbridge top-dressing manure.	Rochester.	1459
Bowker Fertilizer Co., Boston, Mass.	Sure crop.	Rochester.	1450
Bradley Fertilizer Co., Boston, Mass.	Alkaline bone.	Rochester.	1499
Bradley Fertilizer Co., Boston, Mass.	Ammoniated dissolved bone.	Rochester.	1497
Bradley Fertilizer Co., Boston, Mass.	Complete manure for potatoes and vegetables.	Gravesend. Jamaica. Greenport.	1470 1505 1531
Bradley Fertilizer Co., Boston, Mass.	Dissolved bone with potash.	Rochester.	1495
Bradley Fertilizer Co., Boston, Mass.	Eureka super-phosphate.	Rochester.	1483

NEW YORK STATE FOR THE SPRING OF 1894 — (Continued).

	NITROGEN.		PHOSPHORIC ACID.			Potash soluble in water. Ex- pressed as actual potash.
	Expressed as nitrogen.	Equivalent to ammonia.	Available.	Insoluble.	Total.	
Guaranteed. Found.	2.5 to 3.3 2.94	3 to 4 2.72	8 to 10 10.74	..... 3.94	10 to 13 13.98	4 to 6 6.41
Guaranteed. Found.	1.65 to 2.5 2.48	2 to 3 3.01	9 to 11 9.76	..... 4.38	11 to 13 14.04	3 to 4 2.86
Guaranteed. Found.	2.5 to 3.3 3.31	3 to 4 4.03	8 to 10 8.59	2 to 3 2.93	10 to 13 11.44	4 to 6 6.51
Guaranteed. Found.	4.1 to 4.95 5.36	5 to 6 6.39	5 to 6 5.39	..... 4.38	6 to 8 9.67	5 to 6 6.99
Guaranteed. Found.	3.3 to 4.1 3.38	4 to 5 4.1	6 to 8 8.64	..... 2.8	8 to 10 10.84	7 to 8 6.96
Guaranteed. Found.	4.1 to 4.95 4.69	5 to 6 5.6	4 to 5 6.15	..... 2.58	5 to 6 8.68	5.5 to 6.5 5.4
Guaranteed. Found.	3 to 4 5.31	3.7 to 4.9 6.44	7 to 8 5.03	..... 2.86	8 to 10 7.88	5 to 6 5.94
Guaranteed. Found.	3.3 to 4.1 3.33	4 to 5 4.03	5 to 7 7.6	..... 2.33	7 to 9 9.92	7 to 9 6.48
Guaranteed. Found.	3.3 to 4.1 3.33	4 to 5 4.03	5 to 7 7.49	..... 2.55	7 to 9 10.04	7 to 9 7.36
Guaranteed. Found.	4.95 to 5.75 4.91	6 to 7 5.96	3 to 4 5.06	..... 2.88	6 to 7 7.96	5 to 6 6.19
Guaranteed. Found.	0.88 to 1.65 2.17	1 to 2 2.63	8 to 10 11.09	..... 3.94	10 to 13 14.33	1 to 2 1.39
Guaranteed. Found.	..... .....	..... .....	11 to 15 10.74	1 to 2 2.68	12 to 17 13.43	2.4 to 3.5 2.8
Guaranteed. Found.	1.65 to 2.5 1.84	2 to 3 2.23	7 to 9 8.74	..... 3.33	8 to 10 12.07	1.5 to 2 1.64
Guaranteed. Found.	3.7 to 5.1 3.53	4.5 to 5 4.37	8.5 to 10 8.48	..... 2.38	10 to 13 10.76	7 to 8 7.33
Guaranteed. Found.	..... .....	..... .....	9 to 10 8.96	..... 1.38	..... 10.36	2.7 to 3.25 2.15
Guaranteed. Found.	..... .....	..... .....	9 to 11 10.5	1 to 2 2.95	10 to 13 13.45	3.25 to 4.3 3.33

## XX. RESULTS OF ANALYSES OF COMMERCIAL FERTILIZERS IN

MANUFACTURER.	Trade name or brand.	Locality where sample was taken.	Station number.
Bradley Fertilizer Co., Boston, Mass.	Farmers' new method.	Rochester.	1406
Bradley Fertilizer Co., Boston, Mass.	Fine ground bone.	Rochester.	1410
Bradley Fertilizer Co., Boston, Mass.	Grain fertilizer.	Rochester.	1430
Bradley Fertilizer Co., Boston, Mass.	High grade tobacco.	Rochester.	1417
Bradley Fertilizer Co., Boston, Mass.	Justice dissolved bone.	Rochester.	1408
Bradley Fertilizer Co., Boston, Mass.	Justice dissolved boneblack.	Rochester.	1414
Bradley Fertilizer Co., Boston, Mass.	Justice brand German potash salts.	Rochester.	1434
Bradley Fertilizer Co., Boston, Mass.	Justice prepared blood.	Rochester.	1416
Bradley Fertilizer Co., Boston, Mass.	Justice treated blood.	Rochester.	1415
Bradley Fertilizer Co., Boston, Mass.	Niagara phosphate.	Rochester.	1403
Bradley Fertilizer Co., Boston, Mass.	Patent superphosphate of lime.	Rochester.	1413
Bradley Fertilizer Co., Boston, Mass.	Potato fertilizer.	Rochester.	1411
Bradley Fertilizer Co., Boston, Mass.	Sea-fowl guano.	Rochester.	1412
Bradley Fertilizer Co., Boston, Mass.	Sea-fowl tobacco guano.	Rochester.	1419
Bradley Fertilizer Co., Boston, Mass.	Tobacco fertilizer.	Rochester.	1418
The Chioopee Guano Co., New York city.	A 1 potato manure	Hagedorn's Mills.	1590

NEW YORK STATE FOR THE SPRING OF 1894 — *Continued.*

	NITROGEN.		PHOSPHORIC ACID.			Potash soluble in water. Ex- pressed as actual potash.
	Expressed as nitrogen.	Equivalent to ammonia	Available.	Insoluble.	Total.	
Guaranteed. Found.	0.83 to 1.65 1.42	1 to 2 1.72	8 to 10 8.67	..... 1.65	10 to 12 10.32	2.15 to 3.25 2.33
Guaranteed. Found.	2.5 to 3.3 3.96	3 to 4 4.8	..... 6.47	..... 11.85	21 to 23 18.83	.....
Guaranteed. Found.	2.05 to 2.9 2.08	2.5 to 3.5 2.53	11 to 12 11.82	1.5 to 2.5 6.13	12.5 to 14.5 17.45	1.1 to 1.6 0.91
Guaranteed. Found.	5.75 to 6.6 6.21	7 to 8 7.61	..... 3.5	..... 2.71	4 to 5 6.21	10.8 to 12.4 11.19
Guaranteed. Found.	..... .....	..... .....	12 to 15 12.47	1 to 2 2.54	13 to 16 15.01	..... .....
Guaranteed. Found.	..... .....	..... .....	15 to 16 15.07	1 to 2 0.07	16 to 19 15.14	..... .....
Guaranteed. Found.	..... .....	..... .....	..... .....	..... .....	..... .....	12.4 to 14 11.97
Guaranteed. Found.	8.15 to 9.85 7.9	10 to 12 9.59	..... .....	..... .....	..... .....	..... .....
Guaranteed. Found.	4.95 to 6.6 6.35	6 to 8 7.71	..... .....	..... .....	..... .....	..... .....
Guaranteed. Found.	0.63 to 1.65 1.23	1 to 2 1.49	7 to 9 7.81	..... 1.89	8 to 10 9.7	1.1 to 1.6 1.58
Guaranteed. Found.	2.05 to 2.9 2.24	2.5 to 3.5 2.72	8 to 10 9.72	..... 2.18	10 to 12 11.9	1.5 to 2.5 1.82
Guaranteed. Found.	2.05 to 2.9 2.41	2.5 to 3.5 2.93	9 to 10 8.86	..... 5.3	11 to 12 14.16	3.25 to 4.3 2.78
Guaranteed. Found.	2.05 to 2.9 3.98	2.5 to 3.5 4.83	8 to 10 10.37	..... 2.49	10 to 12 12.76	1.5 to 2.5 1.81
Guaranteed. Found.	2.4 2.96	2.9 3.59	8 8.87	1.75 2.69	9.75 11.56	2 2.88
Guaranteed. Found.	3.3 to 4.1 3.19	4 to 5 3.87	8 to 10 9.51	2 to 3 1.82	10 to 12 11.88	4 to 5 4.06
Guaranteed. Found.	2.9 to 4.1 2.7	3.5 to 5 3.28	7 to 9 7.64	2 to 3 1.69	9 to 12 9.33	5 to 7 5.34

## XX. RESULTS OF ANALYSES OF COMMERCIAL FERTILIZERS IN

MANUFACTURER.	Trade name or brand.	Locality where sample was taken.	Station number.
The Chicopee Guano Co., New York city.	Corn and wheat mixture.	Hagedorn's Mills.	1597
The Chicopee Guano Co., New York city.	Farmers' reliable for all crops.	Hagedorn's Mills.	1600
The Chicopee Guano Co., New York city.	Fruit and vine success.	Hagedorn's Mills.	1598
The Chicopee Guano Co., New York city.	Potato grower.	Hagedorn's Mills.	1601
The Chicopee Guano Co., New York city.	Pure raw bone meal.	Hagedorn's Mills.	1602
Clark's Cove Guano Co., New York city.	Great planet A manure.	Flatlands.	1488
Clark's Cove Guano Co., New York city.	Great planet B manure.	Flatlands.	1484
E. Frank Coe, New York city.	Excelsior guano.	Jamaica.	1511
E. Frank Coe, New York city.	Gold brand excelsior guano.	Jamaica. Riverhead.	1513 1505
E. Frank Coe, New York city.	Red band excelsior guano.	Parkville. Jamaica. Riverhead.	1491 1512 1506
Crocker Fertilizer and Chemical Co., Buffalo, N. Y.	Ammoniated bone superphosphate.	Warners.	1610
Crocker Fertilizer and Chemical Co., Buffalo, N. Y.	Ammoniated wheat and corn phosphate.	Marion.	1606
Crocker Fertilizer and Chemical Co., Buffalo, N. Y.	New rival.	Jamaica. Marion.	1594 1597
Crocker Fertilizer and Chemical Co., Buffalo, N. Y.	Potato, hop and tobacco phosphate.	Jamaica. East Marion. Marion.	1505 1574 1608
Crocker Fertilizer and Chemical Co., Buffalo, N. Y.	Special potato.	Marion.	1609
Darling Fertilizer Co., Pawtucket, R. I.	Animal fertilizer—special L. I brand A.	Greenport.	1582

## NEW YORK STATE FOR THE SPRING OF 1894 — (Continued).

	NITROGEN.		/ PHOSPHORIC ACID.			Potash soluble in water. Ex- pressed as actual potash.
	Expressed as nitrogen.	Equivalent to ammonia.	Available.	Insoluble.	Total.	
Guaranteed. Found.	0.83 to 1.65 1.39	1 to 2 1.57	8 to 10 8.65	2 to 3 1.95	10 to 13 10.6	1 to 2 1.37
Guaranteed. Found.	1.65 to 2.5 1.82	2 to 3 2.21	8 to 10 8.69	2 to 3 1.79	10 to 13 10.48	2 to 3 2.26
Guaranteed. Found.	1.26 to 2.5 1.37	1.5 to 3 1.66	8 to 10 8.14	2 to 3 1.66	10 to 13 9.8	5 to 7 5.74
Guaranteed. Found.	1.25 to 2.5 1.53	1.5 to 3 1.86	8 to 10 8.27	2 to 3 1.66	10 to 13 9.93	5 to 7 5.81
Guaranteed. Found.	3.3 4.09	4 4.96	..... 6.56	..... 14.87	21.5 21.43	..... .....
Guaranteed. Found.	3.5 to 4.1 3.67	4.26 to 5 4.46	7.5 to 9.5 8.15	..... 2.01	8.5 to 11.5 10.16	7.5 to 10 7.69
Guaranteed. Found.	4.95 to 6.6 4.54	6 to 8 5.51	5 to 6 5.35	..... 2	6 to 7 7.35	7 to 9 7.08
Guaranteed. Found.	3.3 to 4.1 3.34	4 to 5 4.65	10 to 12 8.77	1 to 2 0.71	..... 9.48	3.4 3.9
Guaranteed. Found.	2.5 to 3.3 2.95	3 to 4 3.58	8 to 10 9.61	1 to 2 1.93	..... 11.54	6 to 8 5.76
Guaranteed. Found.	3.3 to 4.1 3.45	4 to 5 4.19	9 to 12 9.02	1 to 2 0.92	..... 9.94	6 6.56
Guaranteed. Found.	2.9 to 3.7 3.57	3.5 to 4.5 4.33	10 to 12 9.94	1 to 2 1.54	..... 10.78	1 to 2 1.1
Guaranteed. Found.	2.05 to 2.9 2.12	2.5 to 3.5 2.57	10 to 13 9.9	1 to 2 2.34	..... 12.24	1.6 to 2.7 1.74
Guaranteed. Found.	1.25 to 2.05 1.42	1.5 to 2.5 1.72	10 to 12 9.85	1 to 3 1.56	..... 11.41	1.6 to 2.7 1.99
Guaranteed. Found.	2.05 to 2.9 2.15	2.5 to 3.5 2.61	10 to 12 9.83	1 to 2 1.3	..... 11.13	2.2 to 4.3 3.43
Guaranteed. Found.	3.7 to 4.5 3.73	4.5 to 5.5 4.53	8 to 9 8.05	1 to 2 0.44	..... 8.49	5.4 to 6.4 5.44
Guaranteed. Found.	2.9 to 4.1 2.65	3.5 to 5 3.21	..... 7.7	..... 3.08	10 to 12 10.78	7 to 9 6.19

## XX. RESULTS OF ANALYSES OF COMMERCIAL FERTILIZERS IN

MANUFACTURER.	Trade name or brand.	Locality where sample was taken.	Station number
Darling Fertilizer Co., Pawtucket, R. I.	Animal fertilizer—special L. I. brand B.	Greenport.	1533
Darling Fertilizer Co., Pawtucket, R. I.	Animal fertilizer—special L. I. brand C.	Greenport.	1534
Darling Fertilizer Co., Pawtucket, R. I.	Fertilizer for gardens and lawns.	Greenport.	1530
Darling Fertilizer Co., Pawtucket, R. I.	Fine ground bone.	Greenport.	1535
Darling Fertilizer Co., Pawtucket, R. I.	Pure dissolved bone.	Greenport.	1538
Darling Fertilizer Co., Pawtucket, R. I.	The summer king	Southold.	1537
Geo. B. Forrester, New York city.	Cabbage manure.	Flatlands.	1490
Geo. B. Forrester, New York city.	Complete potato manure.	Gravesend, Jamaica.	1469 1503
Great Eastern Fertilizer Co., Rutland, Vt.	General garden special.	Cutchogue.	1582
Great Eastern Fertilizer Co., Rutland, Vt.	Vegetable, vine and tobacco grower.	Bridgehampton.	1589
Hallock & Duryee, Mattituck, L. I.	Lupton's potato fertilizer.	Mattituck.	1556
Hallock & Duryee, Mattituck, L. I.	Mattituck fertilizer.	Mattituck.	1555
Hallock & Duryee, Mattituck, L. I.	Muriate of pot ash.	Mattituck.	1557
Hallock & Duryee, Mattituck, L. I.	No. 1 for potatoes.	Mattituck.	1566
Hallock & Duryee, Mattituck, L. I.	No. 2 for cabbage, cauliflower, etc.	Mattituck.	1566
Hallock & Duryee, Mattituck, L. I.	No. 3.	Mattituck.	1553

NEW YORK STATE FOR THE SPRING OF 1894 — (*Continued*).

	NITROGEN.		PHOSPHORIC ACID.			Potash soluble in water. Ex- pressed as actual potash.
	Expressed as nitrogen.	Equivalent to ammonia	Available.	Insoluble.	Total.	
Guaranteed. Found.	3.7 to 4.5 2.74	4.5 to 5.5 3.32	..... 7.37	..... 5.37	10 to 12 12.74	5 to 6 5.47
Guaranteed. Found.	4.1 to 4.95 3.23	5 to 6 3.92	..... 5.3	..... 3.18	8 to 10 8.48	10 to 12 8.95
Guaranteed. Found.	4.95 to 6.6 3.36	6 to 8 4.03	..... 6.6	..... 4.60	10 to 12 11.2	5 to 6 5.3
Guaranteed. Found.	3.3 to 4.1 2.7	4 to 5 3.28	..... 6.65	..... 17.78	23 to 25 24.43	..... .....
Guaranteed. Found.	2.05 to 2.9 2.68	2.5 to 3.5 2.13	14 to 16 13.73	..... 2.33	16 to 18 15.94	..... .....
Guaranteed. Found.	3.3 to 4.1 2.92	4 to 5 3.54	..... 6.33	..... 3.05	7 to 9 9.28	7 to 10 6.53
Guaranteed. Found.	4.7 5.33	5.75 6.47	5 6.56	..... .....	..... 6.56	7 9.93
Guaranteed. Found.	3.7 4.65	4.5 5.64	5.5 6.5	..... .....	..... 6.5	10 11.58
Guaranteed. Found.	3.3 to 4.1 3.14	4 to 5 3.81	6 to 8 6.44	..... 0.96	..... 7.4	8 to 10 8.87
Guaranteed. Found.	2.05 to 2.9 2.04	2.5 to 3.5 2.48	8 to 12 8.34	1 to 3 1.18	..... 9.53	6 to 8 6.94
Guaranteed. Found.	3.3 to 4.1 3.38	4 to 5 4.1	..... 4.84	..... 1.30	7 to 9 6.04	9 to 11 11.43
Guaranteed Found.	3.3 to 4.1 3.61	4 to 5 4.38	5 to 7 5.46	..... 0.54	..... 6	7 to 9 7.44
Guaranteed. Found.	..... .....	..... .....	..... .....	..... .....	..... .....	50.5 52.4
Guaranteed. Found.	4.1 to 4.95 4.08	5 to 6 4.95	6 to 8 7.03	..... 0.26	..... 7.28	6 to 8 6.84
Guaranteed. Found.	3.3 to 4.1 3.78	4 to 5 4.58	7 to 9 6.66	..... 0.94	..... 7.6	9 to 11 11.16
Guaranteed. Found.	1.65 to 2.5 1.66	2 to 3 2.01	7.5 to 10 7.07	..... 0.14	..... 7.31	12 to 14 12.57

## XX. RESULTS OF ANALYSES OF COMMERCIAL FERTILIZERS IN

MANUFACTURER	Trade name or brand.	Locality where sample was taken.	Station number.
Hallock & Duryee, Mattituck, L. I.	Special garden fertilizer.	Mattituck.	1854
Isaac C. Hendrickson, Jamaica, L. I.	High grade fertilizer.	Jamaica.	1494
S. M. Hess & Bro., Philadelphia, Pa.	Keystone dissolved bone phosphate.	Mattituck.	1566
S. M. Hess & Bro., Philadelphia, Pa.	Potato and truck manure.	Mattituck.	1567
Hubbard & Co., Baltimore, Md.	Farmers' I X L superphosphate	Fayetteville.	1896
Hubbard & Co., Baltimore, Md.	Oriental phosphate.	Lysander.	1393
Hubbard & Co., Baltimore, Md.	Royal ensign.	Lysander.	1395
Hubbard & Co., Baltimore, Md.	Standard bone superphosphate.	Lysander.	1394
Imperial Guano Co., Norfolk, Va.	L. I. special for potatoes and truck.	Flatbush, Jamaica.	1473 1517
Imperial Guano Co., Norfolk, Va.	Seven per cent guano for potatoes.	Flatbush.	1472
Imperial Guano Co., Norfolk, Va.	Special top-dressing for spinach.	Flatbush.	1475
Imperial Guano Co., Norfolk, Va.	Ten per cent guano for cabbage and early truck.	Flatbush, Jamaica.	1476 1516
F. B. Lalor, Dunnville, Ont., Can.	Canada hardwood ashes.	Fairport.	1461
Liebig Manufacturing Co., Carteret, N. J.	Ammoniated dissolved bone.	Moravia.	1435
Liebig Manufacturing Co., Carteret, N. J.	Dissolved bone.	Moravia.	1440

NEW YORK STATE FOR THE SPRING OF 1894 — (Continued).

	NITROGEN.		PHOSPHORIC ACID.			Potash soluble in water Expressed as actual potash.
	Expressed as nitrogen.	Equivalent to ammonia.	Available.	Insoluble.	Total.	
Guaranteed. Found.	3.3 to 4.95 3.74	4 to 6 4.54	11 to 13 10.89	..... 0.81	..... 11.73	2 to 3 3.33
Guaranteed. Found.	3.3 to 4.1 3.35	4 to 5 3.85	4 to 5 5.92	..... 1.37	..... 7.39	3 to 10 19.12
Guaranteed. Found.	0.83 to 1.65 1.06	1 to 3 1.39	8 to 11 10.48	2 to 3 1.82	..... 1.23	1 to 3 1.16
Guaranteed. Found.	2.5 to 3.3 2.37	3 to 4 2.88	8 to 10 8.7	..... 1.4	..... 10.1	6 to 8 5.88
Guaranteed. Found.	1.65 to 2.5 1	2 to 3 1.22	7 to 9 8.28	1.5 to 2 2.24	..... 10.52	1.75 to 2.25 2.12
Guaranteed. Found.	0.83 to 1.25 1.3	1 to 1.5 1.58	8 to 10 8.88	2 to 3 2.34	..... 10.72	1.5 to 2 1.52
Guaranteed. Found.	2.5 2.72	3 3.3	9 8.94	1.5 3.15	..... 11.39	2 2.61
Guaranteed. Found.	1.65 to 2.5 1.74	2 to 3 2.11	9 to 11 8.52	1 to 2 2.46	..... 10.98	2 to 3 2.25
Guaranteed. Found.	4.1 to 4.95 4.49	5 to 6 5.45	7 to 8 7.74	..... 2.91	..... 10.65	7 to 8 9.58
Guaranteed. Found.	5.75 to 6.6 5.69	7 to 8 6.91	7 to 8 7.82	..... 2.07	..... 9.69	8 to 9 8.78
Guaranteed. Found.	8.2 to 9 7.42	10 to 11 9.02	6 to 7 7.17	1 to 2 0.22	..... 7.4	3 to 4 5.88
Guaranteed. Found.	8.2 to 9 7.92	10 to 11 9.61	6 to 7 6.55	2 to 3 2.32	..... 8.78	4 to 5 5.73
Guaranteed. Found.	..... .....	..... .....	..... .....	..... .....	..... .....	5 3.99
Guaranteed. Found.	2.05 to 2.9 2.23	2.5 to 3.5 2.7	10 to 12 10.09	..... 0.18	..... 11.07	2.5 to 3.5 2.53
Guaranteed. Found.	..... .....	..... .....	14 to 15.5 14.25	..... 1.15	..... 15.40	..... .....

## XX. RESULTS OF ANALYSES OF COMMERCIAL FERTILIZERS IN

MANUFACTURER.	Trade name or brand.	Locality where sample was taken.	Station number.
Liebig Manufacturing Co., Carteret, N. J.	Dissolved bone and potash.	Moravia.	1436
Liebig Manufacturing Co., Carteret, N. J.	High grade bone and potash.	Moravia.	1439
Liebig Manufacturing Co., Carteret, N. J.	Standard phosphate.	Moravia.	1437
Liebig Manufacturing Co., Carteret, N. J.	T. and F. bone and potash.	Moravia.	1438
Lister's Agricultural Chemical Works, Newark, N. J.	Ammoniated dissolved bone phosphate.	Rochester.	1443
Lister's Agricultural Chemical Works, Newark, N. J.	Cauliflower and cabbage fertilizer.	Gravesend. Jamaica.	1471 1466
Lister's Agricultural Chemical Works, Newark, N. J.	Celebrated ground bone.	New Suffolk.	1579
Lister's Agricultural Chemical Works, Newark, N. J.	Harvest Queen.	Rochester.	1445 1406
Lister's Agricultural Chemical Works, Newark, N. J.	Perfect.	Rochester.	1449 1605
Lister's Agricultural Chemical Works, Newark, N. J.	Potato manure.	Rochester. Flatlands. Jamaica. Bridgehampton.	1446 1473 1492 1588
Lister's Agricultural Chemical Works, Newark, N. J.	Potato No. 2.	Rochester. New Suffolk. Rochester.	1446 1577 1604
Lister's Agricultural Chemical Works, Newark, N. J.	Standard pure bone phosphate.	Rochester.	1447
Lister's Agricultural Chemical Works, Newark, N. J.	Success.	Rochester. New Suffolk.	1441 1578
Frederick Ludlam, New York city.	A. B. F.	Baiting Hollow.	1539
Frederick Ludlam, New York city.	Dragon's tooth.	Baiting Hollow. Woodhaven.	1518 1580

NEW YORK STATE FOR THE SPRING OF 1894—*Continued.*

	NITROGEN.		PHOSPHORIC ACID.			Potash soluble in water. Expressed as actual potash.
	Expressed as nitrogen.	Equivalent to ammonia.	Available.	Insoluble.	Total.	
Guaranteed Found.	.....	.....	13 to 15 13.34	..... 1.66	..... 15	3 to 4 2.76
Guaranteed Found.	.....	.....	10 to 12 10.64	..... 1.7	..... 12.34	5 to 6 4.86
Guaranteed Found.	1.25 to 2.05 1.86	1.5 to 2.5 1.65	10 to 12 10.71	..... 2.25	..... 11.99	2.5 to 3.5 2.22
Guaranteed Found.	.....	.....	13 to 15 13.93	..... 1.84	..... 14.26	5 to 6 6.17
Guaranteed Found.	1.8 to 2.05 1.76	2.2 to 2.5 2.14	9 to 10 9.11	2 to 3 2.63	..... 11.74	1.5 to 2 1.8
Guaranteed Found.	3.7 to 4.1 3.67	4.5 to 5 4.45	7.5 to 9 8.19	..... 0.59	..... 8.71	7 to 8 7.39
Guaranteed Found.	2.7 to 2.9 3.07	3.25 to 3.5 4.45	..... 3.49	..... 8.99	12 to 14 12.48	.....
Guaranteed Found.	1.25 to 1.65 1.53	1.5 to 2 1.85	9.5 to 11 9.39	..... 3.35	..... 12.74	2 to 3 1.84
Guaranteed Found.	1.25 to 1.65 1.46	1.5 to 2 1.77	9.5 to 11 9.27	..... 2.79	..... 12.06	1.5 to 2.5 2.06
Guaranteed Found.	3.7 to 4.1 3.69	4.5 to 5 4.47	7.5 to 9 7.53	..... 0.96	..... 8.49	7 to 8 7.26
Guaranteed Found.	1.6 to 2.5 2	2.2 to 3 2.43	9.25 to 11 9.5	..... 1.84	..... 11.34	4 to 5 4.39
Guaranteed Found.	2.35 to 2.7 2.36	2.35 to 2.35 2.67	10 to 12 9.65	2 to 3 2.85	..... 12.51	1.5 to 2 2.02
Guaranteed Found.	1.25 to 1.65 1.58	1.5 to 2 1.91	9.5 to 11 9.28	..... 2.57	..... 11.85	2 to 3 2.06
Guaranteed Found.	1.65 to 2.5 1.61	2 to 3 1.95	8 to 10 7.84	..... 4.33	10 to 12 12.16	2 to 3 2.18
Guaranteed Found.	3.3 to 4.1 3.35	4 to 5 3.93	7 to 9 8.08	..... 3.11	..... 11.19	7 to 9 8.19

## XX. RESULTS OF ANALYSES OF COMMERCIAL FERTILIZERS IN

MANUFACTURER.	Trade name or brand.	Locality where sample was taken.	Station number.
Frederick Ludlam, New York City.	Ground bone.	Baiting Hollow.	1508
Frederick Ludlam, New York City.	Kainit.	Bridgehampton.	1507
Frederick Ludlam, New York City.	Sickle brand.	Baiting Hollow.	1501
Mapes Formula and Peruvian Guano Co., New York City.	Cabbage and cauliflower manure.	Flatlands, Jamaica.	1481 1500
Mapes Formula and Peruvian Guano Co., New York City.	Complete manure for light soils.	Flatlands, Jamaica.	1480 1501
Mapes Formula and Peruvian Guano Co., New York City.	Corn manure.	Bridgehampton.	1500
Mapes Formula and Peruvian Guano Co., New York City.	Economical manure.	Bridgehampton.	1500
Mapes Formula and Peruvian Guano Co., New York City.	Potato manure—L. I. special.	Flatlands, Mattituck.	1477 1504
Maryland Fertilizer and Manufacturing Co., Baltimore, Md.	Sangston's cereal and plant food.	Fairport.	1400
Miller Fertilizer Co., Baltimore, Md.	Acid phosphate.	Moravia.	1375
Miller Fertilizer Co., Baltimore, Md.	Harvest queen.	Moravia.	1384
Miller Fertilizer Co., Baltimore, Md.	Hustler phosphate.	Moravia.	1385
Miller Fertilizer Co., Baltimore, Md.	Standard super-phosphate of lime.	Moravia.	1383
Milsom Rendering and Fertilizer Co., Buffalo, N. Y.	Buffalo fertilizer.	Canandaigua, Dundee, Hamburg.	1376 1383 1390
Milsom Rendering and Fertilizer Co., Buffalo, N. Y.	Cyclone bone.	Hamburg.	1388
Milsom Rendering and Fertilizer Co., Buffalo, N. Y.	Dissolved bone.	Dundee.	1381

NEW YORK STATE DURING THE SPRING OF 1894 — (*Continued*).

	NITROGEN.		PHOSPHORIC ACID.			Potash soluble in water. Ex- pressed as actual potash.
	Expressed as nitrogen.	Equivalent to ammonia.	Available.	Insoluble.	Total.	
Guaranteed. Found.	2.5 to 3.3 2.7	3 to 4 3.38	5 to 7 3.41	..... 17.64	18 to 25 21.35	.....
Guaranteed. Found.	..... .....	..... .....	..... .....	..... .....	..... .....	11 to 13 12.08
Guaranteed. Found.	..... .....	..... .....	10 to 12 12.74	..... 0.97	12 to 14 13.71	1 to 2 0.93
Guaranteed. Found.	4.1 to 4.95 4.6	5 to 6 5.58	6 6.8	..... 1.29	6 to 8 8.09	6 to 8 6.69
Guaranteed. Found.	4.95 to 6.6 5.25	6 to 8 6.37	6 to 8 6.62	..... 2.56	8 to 10 9.18	6 to 8 7.67
Guaranteed. Found.	3.7 to 4.1 3.75	4.5 to 5 4.55	8 to 10 8.37	..... 1.99	10 to 12 10.36	6 to 7 7.51
Guaranteed. Found.	2.5 to 3.3 2.7	3 to 4 3.38	6 to 8 7.72	..... 1.64	8 to 10 9.36	8 to 10 9.36
Guaranteed. Found.	3.3 to 4.1 3.48	4 to 5 4.22	6 to 8 6.21	..... 1.69	..... 7.9	7 to 9 8.18
Guaranteed. Found.	1 to 1.65 1.35	1.35 to 2 1.64	10 to 12 9.56	1 to 2 2.85	..... 12.41	2.35 to 3.5 2.55
Guaranteed. Found.	..... .....	..... .....	12 to 15 13.88	2 to 3 1.18	..... 14.56	.....
Guaranteed. Found.	1 to 1.65 1.06	1.35 to 5 1.99	10 to 12 10.77	1.5 to 2 0.52	..... 11.39	2.35 to 3 2.33
Guaranteed. Found.	0.88 to 1.65 0.96	1 to 2 1.17	9 to 11 9.92	1 to 2 0.54	..... 10.48	2.35 to 3 2.34
Guaranteed. Found.	2.35 to 2.7 2.41	2.35 to 3.35 2.93	10 to 12 10.67	1.5 to 2.5 0.56	..... 11.23	2.35 to 3 2.34
Guaranteed. Found.	1.85 to 3.3 2.13	2.35 to 4 2.58	9 to 12 7.87	1 to 3 2.99	10 to 15 10.86	1.5 to 3.5 1.81
Guaranteed. Found.	2.5 to 3.3 2.97	3 to 4 4.81	..... 9.25	..... 14.6	22 to 25 23.86	.....
Guaranteed. Found.	..... .....	..... .....	11 to 13 9.59	1.37 to 2.37 0.89	12.37 to 15.37 10.48	.....

## XX. RESULTS OF ANALYSES OF COMMERCIAL FERTILIZERS IN

MANUFACTURER.	Trade name or brand.	Locality where sample was taken.	Station number.
Millsom Rendering and Fertilizer Co., Buffalo, N. Y.	Erie King.	Canandaigua.	1373
Millsom Rendering and Fertilizer Co., Buffalo, N. Y.	Potato, hop and tobacco phosphate.	Canandaigua. Dundee. Churchville. Southold.	1377 1380 1388 1373
Millsom Rendering and Fertilizer Co., Buffalo, N. Y.	Vegetable bone fertilizer.	Hamburgh.	1391
Millsom Rendering and Fertilizer Co., Buffalo, N. Y.	Wheat, oats and barley phosphate.	Dundee. Churchville.	1379 1389
Moller & Co. Bone Works, Maspeth, L. I.	Champion No. 1.	Canarale. Jamaica. Southold. Cutchogue.	1433 1503 1550 1580
Moller & Co. Bone Works, Maspeth, L. I.	Champion No. 2.	Canarale. Cutchogue.	1439 1581
National Fertilizer Co., Bridgeport, Conn.	Ammoniated bone superphosphate.	Southold.	1572
National Fertilizer Co., Bridgeport, Conn.	Root fertilizer — potatoes, onions, etc.	Queens. Southold.	1586 1571
Pacific Guano Co., New York City.	Dissolved bone phosphate of lime.	Rochester.	1422
Pacific Guano Co., New York City.	Nobeque guano.	Rochester.	1421
Pacific Guano Co., New York City.	Soluble Pacific guano.	Rochester.	1423
Pottstown Iron Co., Pottstown, Pa.	Odorless phosphate.	Jamaica.	1495
Preston Fertilizer Co., Greenpoint, L. I.	Ammoniated bone superphosphate	Queens.	1536
Preston Fertilizer Co., Greenpoint, L. I.	Cabbage and cauliflower fertilizer	Queens.	1539
Preston Fertilizer Co., Greenpoint, L. I.	Potato fertilizer.	Greenpoint.	1537

NEW YORK STATE FOR THE SPRING OF 1894 — (Continued).

	NITROGEN.		PHOSPHORIC ACID			Potash soluble in water. Expressed as actual potash.
	Expressed as nitrogen.	Equivalent to ammonia.	Available.	Insoluble.	Total.	
Guaranteed. Found.	0.83 to 1.25 1.42	1 to 2 1.72	8.45 to 10.45 8.24	2 to 4 2.86	10.45 to 14.45 11.1	1.9 to 2.1 2.5
Guaranteed. Found.	2.05 to 3.3 2.32	2.5 to 4 2.82	8 to 11 8.2	1 to 2 2.6	9 to 13 10.8	4 to 6 3.96
Guaranteed. Found.	4.1 to 4.95 3.12	5 to 6 3.87	8 to 10 8.16	1 to 2 2.03	9 to 13 10.18	5 to 6 4.38
Guaranteed. Found.	1.25 to 3.3 1.62	1.5 to 4 1.97	9 to 10 7.89	1 to 3 4.29	10 to 13 12.18	2 to 3 2.32
Guaranteed. Found.	3.3 to 4.1 3.56	4 to 5 4.32	..... 6.54	..... 3.15	9 to 10 9.72	6 to 8 6.12
Guaranteed. Found.	4.1 to 4.95 4.15	5 to 6 5.03	..... 5.79	..... 3.05	9 to 10 8.84	5 to 7 6.01
Guaranteed. Found.	1.65 to 2.5 2.39	2 to 3 2.9	7 to 9 9.71	..... 1.26	9 to 11 10.97	2 to 4 2.55
Guaranteed. Found.	3.3 to 4.1 3.66	4 to 5 4.44	8 to 10 9.97	..... 0.76	10 to 12 10.73	6 to 8 6.15
Guaranteed. Found.	..... .....	..... .....	12 to 16 12.19	..... 2.14	13 to 18 14.33	..... .....
Guaranteed. Found.	1.25 to 1.65 1.47	1.5 to 2 1.78	5 to 7 7.8	..... 4.8	9 to 14 12.6	2 to 3 2.2
Guaranteed. Found.	2.05 to 2.9 2.56	2.5 to 3.5 3.11	8 to 11 10.85	2 to 3 1.3	10 to 14 12.15	2 to 3.5 1.52
Guaranteed. Found.	..... .....	..... .....	9.7 6.69	9.3 12.74	19 19.43	..... .....
Guaranteed. Found.	2.5 to 3.3 2.16	3 to 4 2.62	9 to 11 8.88	..... 1.71	..... 10.59	2 to 3 4.36
Guaranteed. Found.	3.3 to 4.1 3.52	4 to 5 4.27	5 to 7 6.47	..... 2.66	..... 9.18	7 to 9 6.52
Guaranteed. Found.	3.3 to 4.1 3.18	4 to 5 3.86	7 to 9 7.03	..... 1.06	..... 8.11	8 to 9 7.17

## XX. RESULTS OF ANALYSES OF COMMERCIAL FERTILIZERS IN

MANUFACTURER.	Trade name or brand.	Locality where sample was taken.	Station number.
The Quinniplac Co., New York City.	Ammoniated dissolved bone.	Rochester. Lyons.	1398 1443
The Quinniplac Co., New York City.	Climax.	Rochester. Lyons.	1401 1444
The Quinniplac Co., New York City.	Cross brand fish bone and potash.	East Marion.	1575
The Quinniplac Co., New York City.	Fish and potash.	Greenport.	1539
The Quinniplac Co., New York City.	Fish bone and potash.	Rochester.	1402
The Quinniplac Co., New York City.	Market garden manure.	Jamaica.	1507
The Quinniplac Co., New York City.	Mohawk.	Rochester.	1399
The Quinniplac Co., New York City.	Potato manure.	East Marion.	1576
The Quinniplac Co., New York City.	Potato phosphate.	Rochester.	1409
The Quinniplac Co., New York City.	Soluble dissolved bone.	Rochester.	1397
Read Fertilizer Co., New York City.	High grade farmer's friend.	Southold.	1547
Read Fertilizer Co., New York City.	New York State.	Moravia.	1387
Read Fertilizer Co., New York City.	Standard super-phosphate.	Moravia.	1386
Standard Fertilizer Co., Boston, Mass.	Bone and potash.	Rochester.	1424
Standard Fertilizer Co., Boston, Mass.	Potato and tobacco fertilizer.	Rochester.	1425
Standard Fertilizer Co., Boston, Mass.	Standard guano.	Rochester.	1436

NEW YORK STATE FOR THE SPRING OF 1894— (Continued).

	NITROGEN.		PHOSPHORIC ACID.			Potash soluble in water. Ex- pressed as actual potash.
	Expressed as nitrogen.	Equivalent to ammonia.	Available.	Insoluble.	Total.	
Guaranteed. Found.	1.65 to 2.5 1.83	2 to 2 2.21	9 to 12 9.52	1 to 2 3.12	10 to 14 12.64	2 to 3 2.3
Guaranteed. Found.	1 to 1.65 1.26	1.93 to 2 1.53	8 to 11 8.12	1 to 2 3.83	9 to 13 11.95	2 to 3 2.06
Guaranteed. Found.	3.3 to 4.1 3.33	4 to 5 4.04	3 to 5 3.31	..... 3.44	5 to 8 6.75	3 to 5 3.79
Guaranteed. Found.	2.05 to 2.9 2.37	2.5 to 3.5 2.88	4 to 6 5.99	2 to 3 3.32	6 to 9 9.31	4 to 6 4.43
Guaranteed. Found.	1.65 to 2.5 1.86	2 to 2 2.22	9 to 12 9.33	1 to 2 3.57	10 to 12 12.9	1 to 1.5 1.65
Guaranteed. Found.	3.3 to 4.1 3.58	4 to 5 4.34	8 to 11 9	..... 2.35	9 to 11 11.35	7 to 8 6.88
Guaranteed. Found.	0.83 to 1.65 1.22	1 to 2 1.48	7 to 9 7.14	1 to 2 3.92	8 to 11 11.06	1 to 2 1.24
Guaranteed. Found.	2.5 to 3.3 2.39	3 to 4 2.9	6 to 9 6.74	..... 4.06	7 to 11 10.8	5 to 6 5.72
Guaranteed. Found.	2.05 to 2.9 2.12	2.5 to 3.5 2.57	8 to 11 8.61	1 to 2 3.63	9 to 13 12.24	3 to 4 2.61
Guaranteed. Found.	..... .....	..... .....	12 to 15 10.63	1 to 2 3.40	13 to 17 14.05	..... .....
Guaranteed. Found.	3.3 to 4.1 3.26	4 to 5 3.96	7 to 9 7.47	.... 0.6 ....	..... 8.07	7 to 9 6.81
Guaranteed. Found.	1.25 to 2.05 1.45	1.5 to 2.5 1.78	9 to 11 8.86	2 to 4 1.64	11 to 13 10.5	2 to 4 1.76
Guaranteed. Found.	0.83 to 1.65 1.02	1 to 2 1.24	8 to 10 7.96	2 to 4 1.18	10 to 12 9.14	4 to 6 3.94
Guaranteed. Found.	..... .....	..... .....	8 to 12 8.72	4 to 5 2.91	12 to 17 11.63	2.5 to 3.25 2.76
Guaranteed. Found.	2.05 to 2.9 2.04	2.5 to 3.5 2.48	8 to 11 9.78	1 to 2 2.64	9 to 13 12.42	3 to 4 3.07
Guaranteed. Found.	1 to 2.5 1.26	1.25 to 2 1.63	8 to 12 9.45	2 to 3 1.25	10 to 15 10.7	2 to 3 2.22

## XX. RESULTS OF ANALYSES OF COMMERCIAL FERTILIZERS IN

MANUFACTURER.	Trade name or brand.	Locality where sample was taken.	Station number.
I. P. Thomas & Son, Philadelphia, Pa.	Farmers' choice bone phosphate.	Greenport.	1543
I. P. Thomas & Son, Philadelphia, Pa.	Improved super-phosphate.	Queens.	1534
I. P. Thomas & Son, Philadelphia, Pa.	Potato manure.	Queens. Greenport.	1535 1541
I. P. Thomas & Son, Philadelphia, Pa.	Tip top raw bone phosphate.	Greenport.	1. 40
Ellsworth Tuthill & Co., Promised Land, L. I.	Cutchogue Farmers' Club fertilizer.	Cutchogue.	1543
Ellsworth Tuthill & Co., Promised Land, L. I.	No. 1 fertilizer.	Promised Land.	1545
Ellsworth Tuthill & Co., Promised Land, L. I.	No. 2 fertilizer.	Mattituck.	1569
Ellsworth Tuthill & Co., Promised Land, L. I.	Riverhead Town Agricultural Society fertilizer.	Aquebogue.	1544
Ellsworth Tuthill & Co., Promised Land, L. I.	Special fertilizer.	Mattituck.	1570
Tygart-Allen Fertilizer Co., Philadelphia, Pa.	Cabbage manure.	Flatbush. Jamaica.	1435 1515
Tygart-Allen Fertilizer Co., Philadelphia, Pa.	Popular phosphate.	Bridgehampton.	1594
Tygart-Allen Fertilizer Co., Philadelphia, Pa.	Potato manure.	Flatbush. Hollis. Southold.	1436 1542 1548
Tygart-Allen Fertilizer Co., Philadelphia, Pa.	Special brand potato fertilizer.	Southold.	1549
Tygart-Allen Fertilizer Co., Philadelphia, Pa.	Ten per cent. guano.	Flatbush. Hollis.	1487 1523
Walker Fertilizer Co., Clifton Springs, N. Y.	Ammoniated phosphate.	Clifton Springs.	1462
Walker Fertilizer Co., Clifton Springs, N. Y.	Clifton.	Clifton Springs.	1466

## NEW YORK STATE FOR THE SPRING OF 1894—(Continued).

	NITROGEN.		PHOSPHORIC ACID.			Potash soluble in water. Ex- pressed actual potash.
	Expressed as nitrogen.	Equivalent to ammonia.	Available.	Insoluble.	Total.	
Guaranteed. Found.	1.65 to 2.3 2.17	2 to 3 2.63	9.5 to 11 9.91	1 to 2 2.74	..... 11.95	2 to 4 3.66
Guaranteed. Found.	0.4 to 1.65 0.74	0.5 to 2 0.89	12 to 15 12.46	2 to 3 1.13	..... 13.59	..... .....
Guaranteed. Found.	2.5 to 3.3 3.18	3 to 4 3.86	9 to 11 9.7	1 to 2 0.22	..... 9.92	6 to 8 6.07
Guaranteed. Found.	2.5 to 4.1 3.25	3 to 5 3.92	10 to 12 8.92	2 to 4 1.13	..... 10.05	2 to 4 3.46
Guaranteed. Found.	4.1 3.84	5 4.66	9 7.79	..... 0.77	..... 8.56	10 10.74
Guaranteed. Found.	4.1 4.43	5 5.37	8 7.55	..... 1.10	..... 8.65	10 9.64
Guaranteed. Found.	4.1 4.46	5 5.41	5 3.13	..... 1.70	..... 4.83	7 7.14
Guaranteed. Found.	4.1 4.43	5 5.37	6 6.12	..... 1.48	..... 7.6	10 10.42
Guaranteed. Found.	4.1 4.26	5 5.17	8 6.29	..... 1.10	..... 7.39	10 9.54
Guaranteed. Found.	3.3 to 4.1 3.95	4 to 5 4.79	7 to 8 7.64	..... 1.56	9 to 10 9.2	5 to 6 5.84
Guaranteed. Found.	0.83 to 1.25 1.06	1 to 1.5 1.29	6 to 8 6.86	..... 1.2	9 to 11 8.06	2 to 3 2.21
Guaranteed. Found.	3.3 to 4.1 3.33	4 to 5 4.64	6 to 7 6.6	..... 1.21	9 to 10 7.81	9 to 10 8.86
Guaranteed. Found.	2.05 to 2.9 2.4	2.5 to 3.5 2.91	6 to 8 8.05	..... 0.91	..... 8.96	6 to 8 6.66
Guaranteed. Found.	7.4 to 9 7.64	9 to 11 9.27	5 to 6 5.58	..... 1.59	8 to 9 7.17	5 to 6 5.68
Guaranteed. Found.	1.65 to 2.5 1.7	2 to 3 2.06	8 to 10 8.39	..... 2.41	..... 10.8	1 to 2 1.5
Guaranteed. Found.	2.5 to 3.3 2.27	3 to 4 3.48	10 to 12 9.48	..... 0.67	..... 10.15	2.5 to 3.5 2.61

## XX. RESULTS OF ANALYSES OF COMMERCIAL FERTILIZERS IN

MANUFACTURER.	Trade name or brand.	Locality where sample was taken.	Station number.
Walker Fertilizer Co., Clifton Springs, N. Y.	Old Pittsburgh.	Clifton Springs.	1463
Walker Fertilizer Co., Clifton Springs, N. Y.	Potato and vegetable guano.	Clifton Springs.	1464
Walker Fertilizer Co., Clifton Springs, N. Y.	Pure ground bone.	Clifton Springs.	1467
Walker Fertilizer Co., Clifton Springs, N. Y.	Victoria bone.	Clifton Springs.	1465
Walton & Wann, Wilmington, Del.	Diamond soluble bone.	Venice.	1374
Walton & Wann, Wilmington, Del.	Plow brand raw bone phosphate.	Venice.	1373
Williams & Clark Fertilizer Co., New York city.	Americus ammoniated bone super phosphate.	Rochester. Jamaica.	1427 1550
Williams & Clark Fertilizer Co., New York city.	Americus potato phosphate.	Rochester. Jamaica.	1431 1519
Williams & Clark Fertilizer Co., New York city.	L. I. cabbage phosphate.	Jamaica.	1521
Williams & Clark Fertilizer Co., New York city.	Potato, hop and tobacco manure.	Rochester.	1432
Williams & Clark Fertilizer Co., New York city.	Potato phosphate.	Greenport.	1536
Williams & Clark Fertilizer Co., New York city.	Prolific crop producer.	Rochester.	1429
Williams & Clark Fertilizer Co., New York city.	Royal bone phosphate.	Rochester.	1428
Williams & Clark Fertilizer Co., New York city.	Universal ammoniated dissolved bone.	Rochester.	1430

NEW YORK STATE FOR THE SPRING OF 1894 — (Continued).

	NITROGEN.		PHOSPHORIC ACID.			Potash soluble in water. Ex- pressed as actual potash.
	Expressed as nitrogen.	Equivalent to ammonia.	Available.	Insoluble.	Total.	
Guaranteed. Found.	1.65 to 2.5 1.6	2 to 3 1.94	8 to 10 7.61	2 to 3 1.87	10 to 18 9.48	3 to 4 3.88
Guaranteed. Found.	2.5 to 3.3 2.19	3 to 4 2.66	6 to 8 5.99	..... 0.06	..... 6.07	7 to 8 8.77
Guaranteed. Found.	3.7 to 4.5 3.89	4.5 to 5.5 4.72	..... 6.79	..... 14.51	22 21.1	..... .....
Guaranteed. Found.	0.83 to 1.65 1.28	1 to 2 1.87	8 to 10 7.06	2 to 3 3.52	..... 11.5	1.5 to 2.5 1.06
Guaranteed. Found.	..... .....	..... .....	12 to 15 13.06	1 to 3 2.71	15 to 17 15.79	2.75 to 3.25 2.79
Guaranteed. Found.	2.3 to 2.7 2.76	2.75 to 3.25 3.35	9 to 11 7.91	1 to 3 4.12	12 to 13 12.03	2.25 to 2.75 2.03
Guaranteed. Found.	2.5 to 3.3 2.62	3 to 4 3.18	9 to 11 10.11	1 to 2 2.12	10 to 13 12.23	2 to 3 2.03
Guaranteed. Found.	2.5 to 3.3 2.69	3 to 4 3.27	6 to 9 7.41	1 to 2 1.6	7 to 11 9.01	5 to 6 5.55
Guaranteed. Found.	3.3 to 4.95 2.89	4 to 6 3.51	7 to 9 7.68	..... 3.38	..... 11.06	3 to 5 3.16
Guaranteed. Found.	2.05 to 2.9 2.19	2.5 to 3.5 2.66	8 to 11 8.1	1 to 2 3.63	9 to 13 11.73	3 to 4 2.81
Guaranteed. Found.	2.5 to 3.3 2.66	3 to 4 3.33	7 to 10 6.06	..... 1.92	8 to 10 7.98	6 to 8 5.39
Guaranteed. Found.	0.83 to 1.65 1.55	1 to 2 1.88	6 to 9 7.74	1 to 2 1	7 to 11 8.74	1 to 2 1.88
Guaranteed. Found.	1.25 to 1.65 1.39	1.5 to 2 1.69	7 to 9 7.26	1 to 2 4.48	8 to 11 11.74	2 to 3 2.07
Guaranteed. Found.	1.65 to 2.5 1.76	2 to 3 2.14	8 to 11 9.06	1 to 2 3.43	9 to 13 12.49	2 to 3 2.67

XXI. RESULTS OF ANALYSES OF COMMERCIAL FERTILI-  
*Composition of fertilizers as guaranteed by manufacturers, and as  
 parts per*

MANUFACTURER.	Trade name or brand.	Locality where sample was taken.	Station number.
Armour & Co., Chicago, Ill.	Dissolved bone.	Onelda.	1774
Armour & Co., Chicago, Ill.	Pure bone meal.	Onelda.	1773
Bowker Fertilizer Co., Boston, Mass.	Acid phosphate.	Altamont.	1630
Bowker Fertilizer Co., Boston, Mass.	Alkaline bone.	Romulus.	1653
Bowker Fertilizer Co., Boston, Mass.	Ammoniated dissolved bone.	Columbiaville. Farmer.	1637 1648
Bowker Fertilizer Co., Boston, Mass.	Farm and garden phosphate.	Halls. Le Roy.	1687 1762
Bowker Fertilizer Co., Boston, Mass.	Fresh ground bone.	Penn Yan.	1678
Bowker Fertilizer Co., Boston, Mass.	Hill and drill.	Farmer.	1646
Bowker Fertilizer Co., Boston, Mass.	Square brand bone and phosphate.	Ovid.	1662
Bowker Fertilizer Co., Boston, Mass.	Stockbridge cabbage and cauliflower manure.	Saranac Lake.	1612
Bowker Fertilizer Co., Boston, Mass.	Superphosphate with potash.	Altamont. Le Roy.	1631 1761
Bowker Fertilizer Co., Boston, Mass.	Sure crop.	Columbiaville. Farmer.	1636 1647
Bradley Fertilizer Co., Boston, Mass.	Farmers' new method.	Dresden. Avon.	1669 1755
Bradley Fertilizer Co., Boston, Mass.	Niagara phosphate.	Lyons. Avon.	1703 1754
Bradley Fertilizer Co., Boston, Mass.	Patent superphosphate of lime.	Waterloo. Tuscarora.	1640 1760

ZERS IN NEW YORK STATE FOR THE FALL OF 1894.  
found by chemical analysis at this station. Results expressed in  
hundred.

	NITROGEN.		PHOSPHORIC ACID.			Potash soluble in water. Ex- pressed as actual potash.	Retail selling price per ton.
	Expressed as nitrogen.	Equivalent to ammonia.	Available.	Insoluble.	Total.		
Guaranteed. Found.	1.65 to 2.5 1.74	2 to 3 2.11	9 to 10 8	..... 8.82	..... 16.82	.....	\$36 00 .....
Guaranteed. Found.	2.5 to 3.3 2.12	3 to 4 2.57	..... 5.83	..... 19.46	24 25.28	.....	\$30 00 .....
Guaranteed. Found.	..... .....	..... .....	11 to 12 11.63	..... 3.75	13 to 15 15.37	.....	* .....
Guaranteed. Found.	..... .....	..... .....	11 to 13 10.76	1 to 2 4.82	12 to 15 15.58	1 to 2 0.89	\$34 00 .....
Guaranteed. Found.	1.65 to 2.5 1.65	2 to 3 2	8 to 10 9.56	..... 3.08	10 to 12 12.63	2 to 3 2.75	\$27 00 28 00
Guaranteed. Found.	1.65 to 2.5 1.73	2 to 3 2.12	8 to 11 9.83	2 to 3 2.56	10 to 14 12.39	2 to 3 2.73	\$27 00 28 00
Guaranteed. Found.	2.5 to 3.30 3.25	3 to 4 3.94	5 to 7 6.7	..... 11.87	18 to 22 18.67	.....	\$30 00 .....
Guaranteed. Found.	2.05 to 2.9 2.25	2.5 to 3.5 2.73	8 to 10 7.21	..... 4.25	10 to 12 11.46	2 to 3 2.14	\$32 00 .....
Guaranteed. Found.	1.65 to 2.5 1.85	2 to 3 2.24	..... 5	..... 12.02	12 to 15 17.02	2 to 3 2.22	\$30 00 .....
Guaranteed. Found.	4.1 to 4.95 4.83	5 to 6 5.86	5 to 6 6.96	..... 1.25	6 to 8 8.21	6 to 7 6.88	\$43 00 .....
Guaranteed. Found.	..... .....	..... .....	10 to 12 11.57	..... 3.21	12 to 14 14.58	1 to 2 1.14	* \$20 00
Guaranteed. Found.	0.85 to 1.65 1.17	1 to 2 1.42	8 to 10 9.02	..... 6.27	10 to 12 15.29	1 to 2 1.51	\$25 00 26 00
Guaranteed. Found.	0.85 to 1.65 1.24	1 to 2 1.50	8 to 10 8.31	..... 2.35	10 to 12 10.66	2.15 to 3.25 2.29	* \$27 00
Guaranteed. Found.	0.85 to 1.65 1.11	1 to 2 1.34	7 to 9 8.62	..... 1.90	8 to 10 10.42	1.1 to 1.6 1.67	\$26 00 26 00
Guaranteed. Found.	2.05 to 2.9 2.64	2.5 to 3.5 3.20	8 to 10 10.22	..... 2.89	10 to 12 13.11	1.5 to 2.5 2.05	\$29 00 30 00

## XXI. RESULTS OF ANALYSES OF COMMERCIAL FERTILIZERS IN

MANUFACTURER.	Trade name or brand.	Locality where sample was taken.	Station number.
E. B. Chapin, Rochester, N. Y.	Standard phosphate.	Rochester.	1735
Chemical Co. of Canton, Baltimore, Md.	Ammoniated bone superphosphate.	Skaneateles.	1627
Chemical Co. of Canton, Baltimore, Md.	Ammoniated bone superphosphate	Skaneateles.	1628
Chemical Co. of Canton, Baltimore, Md.	Ammoniated bone superphosphate	Skaneateles.	1629
Chemical Co. of Canton, Baltimore, Md.	Baker's special wheat, corn and grass mixture.	Penn Yan.	1683
Chemical Co. of Canton, Baltimore, Md.	Dissolved bone.	Skaneateles.	1773
Chemical Co. of Canton, Baltimore, Md.	Ontario.	Penn Yan.	1679
The Chesapeake Guano Co., Baltimore, Md.	Alkaline dissolved bone.	Tuscarora.	1736
The Chesapeake Guano Co., Baltimore, Md.	Ammoniated bone superphosphate.	Lyons.	1707
The Chesapeake Guano Co., Baltimore, Md.	Dissolved bone phosphate.	Lyons. Tuscarora.	1706 1757
The Chesapeake Guano Co., Baltimore, Md.	Guano for all crops.	Lyons.	1704
The Chesapeake Guano Co., Baltimore, Md.	New York special No. 1.	Pittsford.	1698
The Chesapeake Guano Co., Baltimore, Md.	New York special No. 2.	Pittsford.	1699
The Chesapeake Guano Co., Baltimore, Md.	Potato grower.	Lyons.	1705
Clark's Cove Guano Co., New York city.	King Philip alkaline guano.	Holley.	1743
Cleveland Dryer Co., Cleveland, O.	Forest City ammoniated superphosphate.	Bergen.	1768

## NEW YORK STATE FOR THE FALL OF 1894 — (Continued).

	NITROGEN.		PHOSPHORIC ACID.			Potash soluble in water. Ex- pressed as actual potash.	Retail selling price per ton.
	Expressed as nitrogen.	Equivalent to ammonia.	Available.	Insoluble.	Total.		
Guaranteed. Found.	1.65 to 2.5 1.93	2 to 5 1.56	8 to 10 8.10	..... 1.75	..... 9.85	1.6 to 2.15 2.85	\$35 00 .....
Guaranteed. Found.	1.65 to 2.5 1.74	2 to 3 2.12	8 to 10 8.56	2 to 3 1.58	10 to 13 0.44	2 to 3 2.3	\$38 00 .....
Guaranteed. Found.	0.85 to 1.65 0.97	1 to 2 1.17	8 to 10 8.59	..... 2.49	..... 11.08	2 to 3 2.64	\$37 00 .....
Guaranteed. Found.	0.85 to 1.65 0.86	1 to 2 1.04	8 to 10 8.85	..... 2.26	..... 10.51	4 to 6 4.23	\$38 00 .....
Guaranteed. Found.	0.85 to 1.65 0.86	1 to 2 1.04	9 to 11 8.83	..... 2.85	11 to 13 11.67	2 to 3 2.83	\$38 00 .....
Guaranteed. Found.	..... .....	..... .....	13 to 15 13.85	2 to 3 1.63	15 to 18 15.18	..... .....	\$18 00 .....
Guaranteed. Found.	0.85 to 1.65 1.08	1 to 2 1.25	8 to 10 7.68	2 to 3 2.92	10 to 13 10.50	4.4 to 5.5 4.35	\$26 00 .....
Guaranteed. Found.	..... .....	..... .....	13 to 15 14.17	1 to 2 0.13	14 to 17 14.3	3 to 5 2.73	\$23 00 .....
Guaranteed. Found.	0.85 1.25	1 1.51	8 8.84	..... 1.63	..... 10.47	1 1.34	\$31 00 .....
Guaranteed. Found.	..... .....	..... .....	14 16.12	2 0.61	16 16.73	..... .....	\$34 00 18 00
Guaranteed. Found.	2.05 2.64	2.5 3.20	9 9.16	..... 1.48	..... 10.64	1 1.39	\$26 00 .....
Guaranteed. Found.	1.25 to 2.05 2.5	1.5 to 2.5 1.92	10 to 12 10.99	1 to 2 0.78	11 to 14 11.77	3 to 5 3.35	\$36 00 .....
Guaranteed. Found.	1.65 to 2.5 2.05	2 to 3 5.49	8 to 10 8.06	1 to 2 2.12	9 to 12 10.18	2 to 3 2.35	\$35 00 .....
Guaranteed. Found.	4.1 4.31	5 5.11	7 7.33	..... 1.45	..... 8.77	8 8.04	\$33 00 .....
Guaranteed. Found.	1 to 1.65 1.59	1.25 to 2 1.93	8 to 10 8.98	1 to 2 2.62	9 to 12 8.60	2 to 3 3.57	\$26 00 .....
Guaranteed. Found.	1.65 to 2.5 2.34	2 to 3 2.84	7 to 9 9.36	..... 2.35	8 to 10 11.61	1 to 2 1.30	\$30 00 .....

## XXI. RESULTS OF ANALYSES OF COMMERCIAL FERTILIZERS IN

MANUFACTURER.	Trade name or brand.	Locality where sample was taken.	Station number.
E. Frank Coe, New York city.	Ammoniated bone superphosphate	Potsdam. Watervliet.	1613 1608
E. Frank Coe, New York city.	XXV ammoniated bone superphosphate.	Potsdam. Dresden.	1615 1608
E. Frank Coe, New York city.	Matchless grain fertilizer.	Potsdam.	1614
E. Frank Coe, New York city.	Soluble bone.	Hayt's Corners.	1656
Crocker Fertilizer and Chemical Co., Buffalo, N. Y.	Ammoniated practical superphosphate.	Fairport.	1716
Crocker Fertilizer and Chemical Co., Buffalo, N. Y.	Ammoniated whey and corn phosphate.	at Farmer. Kendala.	1645 1656
Crocker Fertilizer and Chemical Co., Buffalo, N. Y.	Ammoniated bone superphosphate.	Medina.	1750
Crocker Fertilizer and Chemical Co., Buffalo, N. Y.	A No. 1 bone-black and potash.	Brookport.	1728
Crocker Fertilizer and Chemical Co., Buffalo, N. Y.	Blood and animal matter.	Brookport.	1739
Crocker Fertilizer and Chemical Co., Buffalo, N. Y.	Cereal phosphate	Holley.	1745
Crocker Fertilizer and Chemical Co., Buffalo, N. Y.	Crocker phosphate.	Holley.	1744
Crocker Fertilizer and Chemical Co., Buffalo, N. Y.	Dissolved bone-black.	Canandaigua.	1698
Crocker Fertilizer and Chemical Co., Buffalo, N. Y.	Hanlon Brothers' special phosphate.	Medina.	1749
Crocker Fertilizer and Chemical Co., Buffalo, N. Y.	New rival.	Farmer. Kendala.	1644 1657
Crocker Fertilizer and Chemical Co., Buffalo, N. Y.	Vegetable bone superphosphate.	Fairport.	1717
E. A. Cross, N. Parma, N. Y.	King superphosphate.	N. Parma.	1735

## NEW YORK STATE FOR THE FALL OF 1894—(Continued).

	NITROGEN.		PHOSPHORIC ACID.			Potash soluble in water. Ex- pressed as actual potash.	Retail selling price per ton.
	Expressed as nitrogen.	Equivalent to ammonia.	Available.	Insoluble.	Total.		
Guaranteed Found.	1.65 to 2.05 1.71	2 to 2.5 2.07	8 to 10 9.93	1 to 3 3.05	9 to 13 11.98	1.35 1.34	\$39 00 22 00
Guaranteed. Found.	1 to 1.5 1.16	1.35 to 1.75 1.40	9 to 10 9.90	1 to 3 4.26	..... 14.16	1 1.21	\$25 00 25 00
Guaranteed. Found.	0.6 to 1 1.3	0.75 to 1.25 1.45	11 to 13 10.15	1 to 2 3.19	..... 18.34	1 to 1.5 1.94	\$25 00 .....
Guaranteed. Found.	..... .....	..... .....	12 to 15 11.60	2 to 3 3.88	14 to 18 15.48	..... .....	\$30 00 .....
Guaranteed. Found.	0.85 to 1.65 1.04	1 to 2 1.36	8 to 10 8.40	1 to 3 2.02	... .. 10.43	1 to 2 1.27	\$25 00 .....
Guaranteed. Found.	2.05 to 2.9 2.18	2.5 to 3.5 2.58	10 to 13 9.97	1 to 3 1.73	..... 11.70	1.6 to 2.7 1.65	\$30 00 31 00
Guaranteed. Found.	2.9 to 3.7 3.03	3.5 to 4.5 3.7	10 to 13 9.15	1 to 3 1.63	..... 10.77	1 to 2 1.34	\$30 00 .....
Guaranteed. Found.	1.65 to 2.5 1.68	2 to 3 2.22	10 to 13 10.34	1 to 3 .....	..... 10.24	8 to 10 7.71	*
Guaranteed. Found.	8.35 to 9.90 7.96	10 to 12 9.66	.. .. 4.73	..... 7.37	9 to 11 12.10	..... .....	*
Guaranteed. Found.	0.85 to 1.65 0.98	1 to 3 1.19	8 to 10 9.07	1 to 2 1.39	..... 10.46	3.25 to 4.3 2.59	\$35 00 .....
Guaranteed. Found.	1.25 to 2.5 1.27	1.5 to 3 1.54	10 to 13 10.38	1 to 3 1.75	..... 12.13	1.6 to 2.7 1.99	\$28 00 ....
Guaranteed. Found.	..... .....	..... .....	16 to 18 16.89	..... .....	..... .....	..... .....	*
Guaranteed. Found.	..... .....	..... .....	10 to 12 11.12	1 to 2 0.55	..... 11.67	8 to 9 8.95	\$25 00 .....
Guaranteed. Found.	1.25 to 2.05 1.28	1.5 to 2.5 1.55	10 to 13 10.05	1 to 3 1.85	..... 11.90	1 to 3 1.86	\$28 00 28 00
Guaranteed. Found.	5 to 5.75 5.6	6 to 7 6.8	6 to 7 6.39	1 to 2 0.22	..... 6.61	6 to 8 6.42	\$40 00 .....
Guaranteed. Found.	2.05 to 2.5 2.48	2.5 to 3 3	7 to 9 6.59	..... 2.8	9 to 11 9.39	2 to 3 3.72	\$27 00 .....

## XXI. RESULTS OF ANALYSES OF COMMERCIAL FERTILIZERS IN

MANUFACTURERS.	Trade name or brand.	Locality where sample was taken.	Station number.
E. A. Cross, N. Parma, N. Y.	Parma phosphate.	N. Parma.	1737
E. A. Cross, N. Parma, N. Y.	Queen phosphate.	N. Parma.	1738
J. H. Devins, Utica, N. Y.	J. H. Devins' phosphate.	Utica.	1770
John Finster, Rome, N. Y.	Home trade bone eagle phosphate.	Rome.	1772
Great Eastern Fertilizer Co., Rutland, Vt.	Dissolved bone.	Voorheesville.	1632
Great Eastern Fertilizer Co., Rutland, Vt.	English wheat grower.	Voorheesville.	1633
Great Eastern Fertilizer Co., Rutland, Vt.	Grain and grass fertilizer.	Voorheesville.	1634
Ira C. Hall, Farmer, N. Y.	.....	Farmer.	1650
Liebig Manufacturing Co., Carteret, N. J.	Dissolved bone.	Moravia.	1622
Liebig Manufacturing Co., Carteret, N. J.	Dissolved bone and potash.	Moravia.	1623
Liebig Manufacturing Co., Carteret, N. J.	High grade bone and potash.	Moravia.	1621
Liebig Manufacturing Co., Carteret, N. J.	Standard phosphate.	Moravia.	1619
Liebig Manufacturing Co., Carteret, N. J.	T and F. bone and potash.	Moravia.	1620
Lister's Agricultural Chemical Works, Newark, N. J.	Ammoniated dissolved bone.	Halls.	1698
Lister's Agricultural Chemical Works, Newark, N. J.	Animal bone and potash No. 1.	Rochester.	1767
Lister's Agricultural Chemical Works, Newark, N. J.	Animal bone and potash No. 2.	Rochester.	1769

NEW YORK STATE FOR THE FALL OF 1894 — (Continued).

	NITROGEN.		PHOSPHORIC ACID.			Potash soluble in water. Expressed as actual potash.	Retail selling price per ton.
	Expressed as nitrogen.	Equivalent to ammonia.	Available.	Insoluble.	Total.		
Guaranteed Found.	0.85 to 1.25 2	1 to 1.5 2.43	7 to 8 7.07	..... 2.13	8 to 10 9.19	2 to 3 3.35	\$23 00 .....
Guaranteed Found.	1.35 to 1.65 2.05	1.5 to 2 2.49	7 to 9 6.99	..... 2.96	9 to 11 9.88	2 to 3 3.57	\$24 00
Guaranteed Found.	2.5 to 3.3 2.45	3 to 4 3.97	7 to 9 7.54	1 to 2 1.13	..... 8.66	2 to 3 2.86	\$22 00
Guaranteed Found.	2.5 to 3.3 1.34	3 to 4 1.62	8 to 12 6.52	1 to 2 1.71	..... 9.53	2 to 3 1.88	\$ 5 00
Guaranteed Found.	..... .....	..... .....	13 to 15 11.88	..... 2.43	..... 14.31	..... .....	\$17 00 .....
Guaranteed Found.	0.85 to 1.65 1.06	1 to 2 1.28	8 to 12 8.63	1 to 2 2.02	..... 10.65	2 to 4 2.2	\$30 00
Guaranteed Found.	2.5 to 3.3 2 17	3 to 4 3.63	8 to 12 8 52	1 to 2 1.04	..... 9.56	2 to 4 2.43	\$30 00
Guaranteed Found.	0.5 to 0.85 0.66	0.6 to 0.8 0.80	4 8 to 6 5 55	..... 1.18	..... 6.73	4 6 to 5 2.3	\$30 00
Guaranteed Found.	..... .....	..... .....	14 to 15 15.17	..... 0.99	..... 16.16	..... .....	\$ 7 00
Guaranteed Found.	..... .....	..... .....	13 to 15 12.72	..... 1.17	..... 14.43	3 to 4 2.35	\$22 00
Guaranteed Found.	..... .....	..... .....	10 to 12 11.56	..... 1.81	..... 13.87	5 to 6 3.67	\$22 00
Guaranteed Found.	1.25 to 2.05 1.31	1.5 to 2.5 1.59	10 to 12 11.14	..... 1.13	..... 12 27	2.5 to 3.5 2 24	\$25 00
Guaranteed Found.	..... .....	..... .....	13 to 15 13 95	..... 0.63	..... 14.58	5 to 6 3.36	\$24 00
Guaranteed Found.	.06 to 2.05 2	2.2 to 2.5 2.43	9 to 10 8.88	2 to 3 2 53	..... 11.4	1.5 to 2 1.66	\$27 00 .....
Guaranteed Found.	..... .....	..... .....	9 to 11 10.99	1 to 1.5 0.30	..... 11.39	5 to 7 4.97	\$36 00 .....
Guaranteed Found.	..... .....	..... .....	10 to 12 11.21	1 to 2 0.44	..... 11.68	2 to 5 2.9	\$34 00 .....

## XXI. RESULTS OF ANALYSES OF COMMERCIAL FERTILIZERS IN

MANUFACTURER.	Trade name or brand.	Locality where sample was taken.	Station number.
Lister's Agricultural Chemical Works, Newark, N. J.	Crescent bone dust.	Rochester.	1768
Lister's Agricultural Chemical Works, Newark, N. J.	Perfect.	Canandaigua.	1699
Lister's Agricultural Chemical Works, Newark, N. J.	Plain dissolved bone-black.	Brockport.	1742
Lister's Agricultural Chemical Works, Newark, N. J.	Pure bone super-phosphate of lime.	Pittsford.	17 0
Lister's Agricultural Chemical Works, Newark, N. J.	Success.	Pittsford.	1701
Lonergan & Livingstone, Albany, N. Y.	.....	Albany.	1635
Frederick Ludlam, New York city.	A. B. F.	Fairport.	1715
Frederick Ludlam, New York city.	Cereal.	Moravia.	1617
Frederick Ludlam, New York city.	Dragon's tooth.	Fairport.	1714
Frederick Ludlam, New York city.	Sickle.	Moravia.	1616
Mapes Formula and Peruvian Guano Co., New York city.	Complete manure.	Honeoye Falls.	1731
Maryland Fertilizing and Manufacturing Co., Baltimore, Md.	Alkaline bone.	Fairport.	1712
Maryland Fertilizing and Manufacturing Co., Baltimore, Md.	Tornado.	Fairport.	1713
Michigan Carbon Works, Detroit, Mich.	Homestead.	Ovid. Honeoye Falls. Tuscarora.	1664 1740 1758
Michigan Carbon Works, Detroit, Mich.	Jarves' drill phosphate.	Ovid.	1663
Miller Fertilizer Co., Baltimore, Md.	Harvest Queen.	Moravia.	1618

## NEW YORK STATE FOR THE FALL OF 1894 — (Continued).

	NITROGEN.		PHOSPHORIC ACID.			Potash soluble in water. Ex- pressed as actual potash.	Retail selling price per ton.
	Expressed as nitrogen	Equivalent to ammonia	Available.	Insoluble	Total.		
Guaranteed. Found.	2.25 to 3.1 2.84	2.75 to 3.75 3.45	..... 2.78	..... 11.13	11 to 13 13.91	..... .....	\$28 00 .....
Guaranteed. Found.	1.25 to 1.65 1.8	1.5 to 2 2.18	9.5 to 11 10.09	..... 2.23	..... 12.37	2 to 3 2.07	\$25 00 .....
Guaranteed. Found.	..... .....	..... .....	13 to 16 13.69	..... .....	..... 13.69	..... .....	\$24 00 .....
Guaranteed. Found.	2.35 to 2.7 2.51	2.85 to 3.25 3.04	10 to 17 9.31	2 to 3 3.15	..... 12.26	1.5 to 2 1.86	\$29 00 .....
Guaranteed. Found.	1.25 to 1.65 1.7	1.5 to 2 2.06	9.5 to 11 9.9	..... 2.44	..... 12.34	2 to 3 2.02	\$27 00 .....
Guaranteed. Found.	3.7 to 4.5 4.69	4.5 to 5.5. 5.91	8 to 9 8.83	..... 8.36	10 to 11 17.18	..... .....	\$ 5 00 .....
Guaranteed. Found.	1.65 to 2.5 1.69	2 to 3 2.06	8 to 10 10.69	..... 2.46	10 to 12 13.15	2 to 3 2.55	* .. ..
Guaranteed. Found.	0.85 to 1.65 0.95	1 to 2 1.15	8 to 10 10.18	..... 2.65	10 to 12 12.83	1 to 2 1.16	\$26 00 .....
Guaranteed. Found.	3.3 to 4.1 3.6	4 to 5 4.37	7 to 9 9.73	..... 1.77	..... 11.5	7 to 9 6.63	* .....
Guaranteed. Found.	..... .....	..... .....	10 to 13 11.22	..... 8.69	12 to 14 14.91	1 to 2 1	\$22 00 .....
Guaranteed. Found.	3.3 to 4.1 3.78	4 to 5 4.59	8 to 10 8.40	..... 3.02	10 to 12 11.44	4 to 5 4.95	\$41 00 .....
Guaranteed. Found.	..... .....	..... .....	11 to 15 11.95	1 to 3 0.24	..... 13.19	3 to 4 3.74	* .....
Guaranteed. Found.	0.4 to 0.8 0.51	0.5 to 1 0.61	10 to 15 11.91	1 to 3 1.19	..... 13.1	3 to 4 3.8	* .....
Guaranteed. Found.	1.85 to 2.6 2.03	2.25 to 3.15 2.46	8 to 11 9.57	0.5 to 1.5 0.31	..... 9.88	1.5 to 2 1.53	\$30 00 30 00 28 00
Guaranteed. Found.	1 to 1.65 1.59	1.25 to 2 1.56	8 to 9 9.46	2 to 3 1.43	10 to 12 10.88	..... .....	\$27 00 .....
Guaranteed. Found.	1 to 1.65 1.1	1.25 to 2 1.83	10 to 12 10.78	1.5 to 2.5 1.17	..... 11.95	2.25 to 3 2.86	\$26 00 .....

## XXI. RESULT OF ANALYSES OF COMMERCIAL FERTILIZERS IN

MANUFACTURER.	Trade name or brand.	Locality where sample was taken.	Station number.
Miller Fertilizer Co., Baltimore, Md.	Home Rule.	Farmer.	1649
Miller Fertilizer Co., Baltimore, Md.	Pure bone meal.	Farmer.	1651
Millsom Rendering and Fertilizing Co., Buffalo, N. Y.	Buffalo fertilizer.	Ovid. Penn Yan.	1661 1664
Millsom Rendering and Fertilizing Co., Buffalo, N. Y.	Buffalo guano.	Romulus.	1655
Millsom Rendering and Fertilizing Co., Buffalo, N. Y.	Cyclone bone meal.	Canandaigua.	1691
Millsom Rendering and Fertilizing Co., Buffalo, N. Y.	Dissolved bone black.	Honeoye Falls.	1733
Millsom Rendering and Fertilizing Co., Buffalo, N. Y.	Potato, hop and tobacco fertilizer.	Honeoye Falls.	1733
Millsom Rendering and Fertilizing Co., Buffalo, N. Y.	Vegetable bone fertilizer.	Lyons.	1709
Millsom Rendering and Fertilizing Co., Buffalo, N. Y.	Wheat, oats & barley phosphate.	Waterloo. Romulus.	1639 1654
L. Mittenmaier, Rome, N. Y.	Pride of America	Rome.	1771
Niagara Fertilizer Co., Buffalo, N. Y.	Niagara wheat producer.	Parma.	1734
Oakfield Fertilizer Co., Oakfield, N. Y.	Domestic.	Victor.	1703
Oakfield Fertilizer Co., Oakfield, N. Y.	Golden Sheaf.	Victor.	1702
Pacific Guano Co., New York city.	Bone and potash.	Le Roy.	1785
Pacific Guano Co., New York city.	Dissolved bone black.	Reed's Corners.	1695
Pacific Guano Co., New York city.	Nobusque guano.	Reed's Corners.	1694

NEW YORK STATE FOR THE FALL OF 1894—(Continued).

	NITROGEN.		PHOSPHORIC ACID.			Potash soluble in water. Expressed as actual potash.	Retail selling price per ton.
	Expressed as nitrogen.	Equivalent to ammonia.	Available.	Insoluble.	Total.		
Guaranteed.	0.85 to 1.65	1 to 2	9 to 11	1 to 2	.....	2.5 to 3	\$25 00
Found.	0.88	1.05	9.87	0.77	10.14	2.53	.....
Guaranteed.	3.3 to 4.1	4 to 5	.....	.....	20 to 23	.....	\$30 00
Found.	3.83	4.65	8.13	13.93	22.06	.....	.....
Guaranteed.	1.85 to 3.3	2.25 to 4	9 to 12	1 to 3	10 to 15	1.5 to 2.5	\$30 00
Found.	2.04	2.47	8.54	2.28	10.92	1.42	25 00
Guaranteed.	0.85 to 1.65	1 to 2	10 to 12	1 to 3	11 to 15	1 to 2	\$28 00
Found.	1.1	1.33	9.08	1.99	11.17	1.32	.....
Guaranteed.	2.5 to 3.3	3 to 4	.....	.....	22 to 25	.....	\$32 00
Found.	2.75	3.34	8.19	18.49	26.53	.....	.....
Guaranteed.	.....	.....	16 to 18	.....	.....	.....	\$24 10
Found.	.....	.....	16.65	0.24	16.89	.....	.....
Guaranteed.	2.05 to 3.3	2.5 to 4	8 to 11	1 to 2	9 to 13	4 to 6	\$22 00
Found.	1.94	2.35	9.12	2.5	11.27	4.74	.....
Guaranteed.	4.1 to 5	5 to 6	8 to 10	1 to 2	9 to 12	5 to 6	\$38 00
Found.	3.99	4.84	8.47	1.87	10.64	5.05	.....
Guaranteed.	1 to 3.3	1.25 to 4	9 to 10	1 to 3	10 to 13	2 to 3	\$27 00
Found.	1.32	1.48	7.7	2.03	9.76	2.44	28 00
Guaranteed.	1.65 to 3.3	2 to 3	.....	.....	6 to 9	3 to 6	\$30 00
Found.	1	1.22	1.51	1.31	2.83	4.03	.....
Guaranteed.	1.25 to 2.05	1.5 to 2.5	8 to 10	1 to 2	.....	4 to 6	\$25 00
Found.	1.51	1.83	9.7	2.88	12.53	3.28	.....
Guaranteed.	1.65 to 2.5	2 to 3	8 to 10	1 to 2	9 to 12	1.08 to 1.62	\$28 00
Found.	1.94	2.35	8.16	3.46	11.62	1.26	.....
Guaranteed.	1.25 to 2.05	1.5 to 2.5	7 to 9	1 to 2	8 to 11	1.9 to 2.45	\$26 00
Found.	1.25	1.51	9.2	0.78	9.98	2.91	.....
Guaranteed.	.....	.....	10 to 12	.....	.....	2.15 to 3.25	\$22 00
Found.	.....	.....	9.21	1.47	10.68	2.41	.....
Guaranteed.	.....	.....	15 to 18	.....	.....	.....	*
Found.	.....	.....	16.79	0.15	16.94	.....	.....
Guaranteed.	1.15 to 1.65	1.4 to 2	9 to 12	.....	.....	2 to 3	*
Found.	1.14	1.50	8.71	2.41	11.12	2.21	.....

## XXI. RESULTS OF ANALYSES OF COMMERCIAL FERTILIZERS IN

MANUFACTURER.	Trade name or brand.	Locality where sample was taken.	Station number.
Pacific Guano Co., New York city.	Soluble Pacific guano.	Reed's Corners.	1690
A. Peterson, Penfield, N. Y.	Penfield fertilizer.	Penfield.	1711
Moro Phillips Chemical Co., Philadelphia, Pa.	O and G complete fertilizer.	Ovid.	1690
Moro Phillips Chemical Co., Philadelphia, Pa.	Dissolved phosphate.	Ovid.	1695
Moro Phillips Chemical Co., Philadelphia, Pa.	Eureka potato phosphate.	Avon.	1758
Moro Phillips Chemical Co., Philadelphia, Pa.	Eureka wheat phosphate.	Avon.	1759
Moro Phillips Chemical Co., Philadelphia, Pa.	Farmers' phosphate.	Penn Yan.	1675
Moro Phillips Chemical Co., Philadelphia, Pa.	Klaine's selected fertilizer.	Ovid.	1690
Moro Phillips Chemical Co., Philadelphia, Pa.	Soluble bone phosphate.	Penn Yan. Canandaigua.	1675 1690
Moro Phillips Chemical Co., Philadelphia, Pa.	Special fertilizer.	Farmer.	1652
Moro Phillips Chemical Co., Philadelphia, Pa.	Yates county fertilizer.	Penn Yan.	1674
Wm. W. Phipps, Albion, N. Y.	Ammoniated dissolved bone with potash.	Albion.	1747
Wm. W. Phipps, Albion, N. Y.	Potato, corn, fruit and vine fertilizer.	Albion.	1748
Wm. W. Phipps, Albion, N. Y.	Superphosphate with potash.	Albion.	1746
Quinnipiac Co., New York city.	Ammoniated dissolved bone.	Benton.	1695
Quinnipiac Co., New York city.	Climax.	Sodus.	1718

## NEW YORK STATE FOR THE FALL OF 1894 — (Continued).

	NITROGEN.		PHOSPHORIC ACID.			Potash soluble in water. Ex- pressed as actual potash.	Retail selling price per ton.
	Expressed as nitrogen.	Equivalent to ammonia.	Available.	Insoluble.	Total.		
Guaranteed. Found.	2.05 to 2.9 2.25	2.5 to 3.5 2.77	8 to 10 9.06	..... 3.54	11 to 14 12.60	1.5 to 2.5 1.83	* .....
Guaranteed. Found.	4.1 to 5 2.57	5 to 6 3.12	10 to 12 8.88	..... 4.74	12 to 15 13.63	4 to 5 5.23	\$30 00 .....
Guaranteed. Found.	1 to 1.65 0.64	1.25 to 2 0.78	8 to 10 9.51	1 to 2 0.74	9 to 12 10.25	1.25 to 2 2.01	\$25 00 .....
Guaranteed. Found.	..... .....	..... .....	12 to 15 12.94	1 to 2 1.22	14 to 17 15.86	..... .....	\$20 00 .....
Guaranteed. Found.	..... .....	..... .....	10 to 12 11.25	1 to 2 1.5	..... 12.75	5.5 to 6.5 4.98	\$30 00 .....
Guaranteed. Found.	..... .....	..... .....	9 to 11 9.69	1 to 2 1.63	10 to 12 11.37	2 to 4 3.4	\$23 00 .....
Guaranteed. Found.	0.83 to 1.65 0.84	1 to 2 1.03	7 to 9 8.3	1 to 2 0.82	..... 8.83	1 to 2 1.35	\$30 00 .....
Guaranteed. Found.	1 to 1.65 0.94	1.25 to 2 1.14	8 to 11 9.59	..... 2.89	11 to 14 12.48	2.5 to 3.5 3.06	\$25 00 .....
Guaranteed. Found.	..... .....	..... .....	14 to 17 14.5	1 to 2 1.63	..... 16.48	..... .....	\$17 00 18 00
Guaranteed. Found.	1.85 to 2.7 1.75	2.25 to 3.25 2.13	9 to 10 9.39	1 to 2 1.84	10 to 12 11.23	4.75 to 5.75 4.74	\$29 00 .....
Guaranteed. Found.	1 to 1.65 0.94	1.25 to 2 1.14	9 to 11 9.35	2 to 3 2.17	11 to 14 11.53	2.5 to 3.5 2.85	\$25 00 .....
Guaranteed. Found.	0.85 to 1.65 0.93	1 to 2 1.12	9 to 11 11.81	..... 0.96	11 to 13 12.07	2 to 4 2.45	\$28 00 .....
Guaranteed. Found.	2.05 to 2.90 1.94	2.5 to 3.5 2.85	8 to 10 9.99	..... 2.45	9 to 11 12.44	7 to 9 6.25	\$36 00 .....
Guaranteed. Found.	..... .....	..... .....	11 to 13 14.1	..... 0.46	12 to 15 14.56	2 to 4 1.91	\$24 00 .....
Guaranteed. Found.	1.65 to 2.5 22.4	2 to 3 2.72	9 to 12 9.64	1 to 2 2.69	10 to 14 12.33	2 to 3 2.03	\$28 00 .....
Guaranteed. Found.	1 to 1.65 1.72	1.25 to 2 2.08	8 to 11 7.71	1 to 2 3.28	9 to 12 10.99	2 to 3 2.08	\$27 00 .....

## XXI. RESULTS OF ANALYSES OF COMMERCIAL FERTILIZERS IN

MANUFACTURER.	Trade name or brand.	Locality where sample was taken.	Station number.
Quinnipiac Co., New York city.	Cross fish bone and potash.	Le Roy.	1764
Basin Fertilizer Co., Baltimore, Md.	Acid phosphate.	Penn Yan.	1689
Read Fertilizer Co., New York city.	Farmers' friend.	Webster.	1721
Read Fertilizer Co., New York city.	Leader guano.	Farmer.	1645
Read Fertilizer Co., New York city.	New York State phosphate.	Webster.	1722
Read Fertilizer Co., New York city.	Standard phosphate.	Webster.	1723
John S. Reese & Co., Baltimore, Md.	Challenge crop grower.	Niles.	1685
John S. Reese & Co., Baltimore, Md.	Crown bone phosphate and potash.	Sodus.	1730
John S. Reese & Co., Baltimore, Md.	Elm bone phosphate.	Gage.	1686
John S. Reese & Co., Baltimore, Md.	Half and half.	Niles.	1684
John S. Reese & Co., Baltimore, Md.	Pilgrim.	Sodus.	1719
John S. Reese & Co., Baltimore, Md.	Wheat special.	Niles.	1688
Rochester Fertilizer Co., Rochester, N. Y.	Blood and bone guano.	Dresden.	1686
Rochester Fertilizer Co., Rochester, N. Y.	Blood and bone guano XX.	Webster.	1744
Rochester Fertilizer Co., Rochester, N. Y.	Genesee guano.	Webster.	1726
Isaac C. Smith, Columbiaville, N. Y.	John Smith's super-phosphate	Columbiaville.	1686

## NEW YORK STATE FOR THE FALL OF 1894 — (Continued).

	NITROGEN.		PHOSPHORIC ACID.			Potash soluble in water. Ex- pressed as actual potash.	Retail selling price per ton.
	Expressed as nitrogen.	Equivalent to ammonia.	Available.	Insoluble.	Total.		
Guaranteed. Found.	1.65 to 2.5 1.85	2 to 3 2.24	9 to 11 9.11	..... 3.77	10 to 12 12.88	1 to 1.5 1.23	\$26 00 .....
Guaranteed. Found.	..... .....	..... .....	14 14.7	1 0.87	15 15.4	..... .....	\$18 00 .....
Guaranteed. Found.	2.05 to 2.9 2.35	2.5 to 3.5 2.85	9 to 11 9.77	..... 0.86	11 to 14 10.63	2 to 4 2.1	\$38 00 .....
Guaranteed. Found.	0.85 to 1.65 1.11	1 to 2 1.34	7 to 8 6.84	..... 1.6	8 to 10 8.49	2 to 3 2.42	\$25 00 .....
Guaranteed. Found.	1.25 to 2.05 0.87	1.5 to 2.5 1.05	9 to 11 8.9	..... 1.11	11 to 13 10.01	2 to 3 4.85	\$25 0 .....
Guaranteed. Found.	0.85 to 1.65 0.95	1 to 2 1.19	8 to 10 8.62	..... 0.76	10 to 12 9.38	4 to 6 4.31	\$25 00 .....
Guaranteed. Found.	0.85 0.9	1 1.09	8.5 9.3	2.75 1.88	..... 11.08	2 1.81	\$35 00 .....
Guaranteed. Found.	..... .....	..... .....	13 to 14 15.3	..... 1.25	14 to 15 16.55	2 to 3 1.47	\$25 0 .....
Guaranteed. Found.	..... .....	..... .....	14 15.22	3 1.28	17 16.50	..... .....	\$30 00 .....
Guaranteed. Found.	0.85 0.79	1 0.95	11 12.91	3 1.09	..... 14	0.6 0.55	..... \$24
Guaranteed. Found.	1.25 to 1.65 1.1	1.5 to 2 1.33	6.5 to 8 7.93	..... 2.54	7.5 to 10.5 10.47	3 to 4 1.49	\$ 0 .....
Guaranteed. Found.	..... .....	..... .....	10 10.19	..... 3.94	..... 14.18	1 0.91	\$22 .....
Guaranteed. Found.	0.85 to 1.65 1.5	1 to 2 1.82	8 to 10 9.12	..... 0.98	..... 10.1	1.6 to 2.7 2.41	\$26 .....
Guaranteed. Found.	0.85 to 1.65 1.05	2 to 3 1.27	8 to 10 6.71	..... 0.85	..... 7.56	4 to 5 4.33	\$24 .....
Guaranteed. Found.	1.65 to 2.5 1.83	2.34 to 3.34 2.22	8 to 10 8.29	..... 0.79	..... 9.08	3.25 to 4.3 3	* .....
Guaranteed. Found.	1.9 to 2.75 1.8	2.34 to 3.34 2.18	6.7 to 8 6.78	2.05 2.63	3.42 to 10.05 9.41	2.06 to 3 2.32	\$25 .....

## XXI. RESULTS OF ANALYSES OF COMMERCIAL FERTILIZERS IN

MANUFACTURER.	Trade name or brand.	Locality where sample was taken.	Station number.
R. H. Stone, Trumansburgh, N. Y.	Eureka.	Trumansburgh.	1611
Standard Fertilizer Co., Boston, Mass.	Standard guano.	Penn Yan. Vincent.	1676 1697
Standard Fertilizer Co., Boston, Mass.	Wheat, oats and barley fertilizer.	Geneseo.	1751
Swift & Co., Chicago, Ill.	Pure ground steamed bone.	Brockport.	1741
Swift & Co., Chicago, Ill.	Raw bone meal.	Brockport.	1740
I. P. Thomas & Son, Philadelphia, Pa.	Special S. C. phosphate.	Penn Yan.	1677
Walker Fertilizer Co., Clifton Springs, N. Y.	Ammoniated phosphate.	Honeoye Falls.	1738
Walker Fertilizer Co., Clifton Springs, N. Y.	Economical bone phosphate.	Dresden.	1667
Walker Fertilizer Co., Clifton Springs, N. Y.	Potato and vegetable grower	Honeoye Falls.	1739
Walker Fertilizer Co., Clifton Springs, N. Y.	Special mixture acid phosphate.	Honeoye Falls.	1737
Walker, Stratman & Co., Pittsburg, Pa.	Banner.	Penn Yan.	1681
Walker, Stratman & Co., Pittsburg, Pa.	Big bonanza.	Penn Yan.	1683
M. E. Wheeler & Co., New York city.	Electrical dissolved bone.	Dundee.	1673
M. E. Wheeler & Co., New York city.	Grass and oats fertilizer.	Dundee.	1671
M. E. Wheeler & Co., New York city.	Royal wheat grower.	Dundee.	1670
Williams & Clark Fertilizer Co., New York city.	Royal bone phosphate.	Le Roy.	1763
Zell Guano Co., Baltimore, Md.	Economizer.	Canandaigua.	1698

\* Not stated

## NEW YORK STATE FOR THE FALL OF 1894 — (Concluded).

	NITROGEN.		PHOSPHORIC ACID.			Potash soluble in water. Expressed as actual potash.	Retail selling price per ton.
	Expressed as nitrogen.	Equivalent to ammonia.	Available.	Insoluble.	Total.		
Guaranteed. Found.	0 to 0.8 0.5	0 to 1 0.6	2 to 6 7.34	..... 2.33	..... 9.67	1 to 4 5.88	\$33 .....
Guaranteed. Found.	1 to 2.5 1.13	1.25 to 3 1.87	9 to 12 8.99	2 to 3 1.96	10 to 15 10.95	2 to 3 2.08	\$38 28
Guaranteed. Found.	.....	.....	10 to 13 10.12	..... 2 14	..... 12.26	3.25 to 5.4 3.01	\$35 .....
Guaranteed. Found.	2.3 to 4.1 3.29	4 to 5 3.99	..... 7.23	..... 17.08	20 to 24 21.36	..... .....	\$30 .....
Guaranteed. Found.	3.7 to 4.5 3.92	4.5 to 5.5 4.76	..... 6.39	..... 18.61	20 to 25 21.9	..... .....	\$33 .....
Guaranteed. Found.	.....	.....	14 to 16 13.37	1 to 2 2.15	..... 15.52	..... .....	\$16 50 .....
Guaranteed. Found.	1.65 to 2.5 1.79	2 to 3 2.17	8 to 10 7.98	..... 2.19	..... 10.17	1 to 2 2.03	\$35 00 .....
Guaranteed. Found.	0.85 to 1.65 0.96	1 to 2 1.19	11 to 13 10.92	2 to 3 1.53	13 to 16 12.45	1 to 2 1.13	* .....
Guaranteed. Found.	2.5 to 3.3 2.67	3 to 4 3.24	6 to 8 5.87	..... 2.55	..... 7.92	7 to 8 7.18	\$32 00 .....
Guaranteed. Found.	.....	.....	12 to 15 15.43	..... 0.35	..... 15.78	..... .....	\$18 00 .....
Guaranteed. Found.	2.05 to 2.9 1.29	2.5 to 3.5 1.56	9 to 10 6.59	1 to 2 2.4	10 to 12 9.99	1.6 to 2.15 1.06	\$37 00 .....
Guaranteed. Found.	2.5 to 3.3 1.43	3 to 4 1 72	10 to 11 12	1 to 2 0.53	12 to 13 12.52	1.1 to 1.6 0.33	\$30 00 .....
Guaranteed. Found.	.....	.....	12 to 17 14.36	2 to 3 1.44	..... 15.8	..... .....	\$22 00 .....
Guaranteed. Found.	.....	.....	10 to 14 10.4	2 to 4 1.39	..... 11.79	2 to 3 2.64	\$25 00 .....
Guaranteed. Found.	0.85 to 1.5 0.9	1 to 2 1.69	8 to 12 9.48	1 to 3 1.32	..... 10.8	2 to 3 2.06	\$37 00 .....
Guaranteed. Found.	1 to 1.65 1.49	1.25 to 2 1.81	7 to 9 7 6	..... 3.99	8 to 11 11.59	2 to 3 2.12	\$26 00 .....
Guaranteed. Found.	0.55 to 1.65 1.07	1 to 2 1.3	9 to 11 1 64	2 to 3 1.24	11 to 14 12.88	1 to 2 1.33	\$24 00 .....

by dealer.



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REPORT  
OF  
HORTICULTURAL WORK.

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S. A. BEACH, HORTICULTURIST.

WENDELL PADDOCK, ASSISTANT HORTICULTURIST.

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## REPORT OF HORTICULTURAL WORK.

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The principal lines of work undertaken in 1894 by the Horticulturist and his Assistant were:

1. A study of some fungous diseases of fruit and remedial treatment of the same.
2. A comparison of apparatus for applying fungicides and insecticides.
3. Testing new varieties of fruit and vegetables.
4. Plant breeding for the purpose of originating improved varieties of fruit.

The constantly increasing correspondence of the Station on horticultural topics demands considerable time.

**Pear Leaf Blight.**—Treatment of pear seedlings for the prevention of the leaf blight, which is so prevalent as to seriously interfere with growing pear seedlings in this country, has been conducted for three seasons. These investigations were carried on in 1892 in co-operation with the United States Division of Vegetable Pathology, but since then the work has been wholly under the direction of the Horticulturist. The results indicate that with the methods thus far tried the disease can not be completely controlled, especially when the seedlings are grown adjacent to infected stock of the previous year; yet spraying with some of the copper mixtures has shown that the ravages of the disease may be very much lessened by such treatment.

**Apple and Pear Scab.**—In 1893 extensive experiments in a commercial pear orchard demonstrated that a weak Bordeaux mixture was thoroughly efficient in controlling the pear scab, and the past season equally as extensive experiments have shown that but three treatments need be made if the applications be timely and thorough, and that similar treatment is successful in preventing apple scab. But a moment's reflection is necessary

to show the practical importance of such investigations to the fruit-growing sections of New York State. A full report of this work is given on subsequent pages.

**Raspberry Anthracnose.**—This disease has become so serious that it has nearly ruined large raspberry plantations in some portions of the State. It is being made the subject of special investigation by Mr. Paddock. The results of the investigation, so far as they may be estimated at present, indicate that the disease may be controlled by proper treatment. A complete report of this work can not be made before the close of another season.

**Spraying Machinery.**—A report on the comparison of apparatus for applying insecticides and fungicides was prepared by Mr. Paddock in connection with the special work in the Second Judicial Department, published in Bulletin 74, and is reprinted in this report.

**Testing Fruits.**—Large numbers of new varieties of fruits are being introduced into cultivation and sometimes old varieties are being sold under new names. It has been the policy of this Station ever since it was established to compare these new fruits with the standard old varieties and report on their merits so far as they may be determined here. With apples and pears the results necessarily appear slowly, since it requires several years after they are grafted or planted for these fruits to come into bearing. A statement of the number of varieties of each kind grown will serve to show how extensively this work is carried on. All of these figures are exclusive of Station seedlings. The apple orchards contain four hundred and thirty-six varieties, many of which are in full bearing. The pear orchard contains twenty-six varieties. Of plums there are one hundred and fifty-nine, seven of quinces, eighty-six of peaches, thirty eight of cherries, one hundred and sixty five of strawberries, forty of raspberries, thirty five of blackberries, thirty-seven of currants, and two hundred and sixteen of gooseberries.

The report on strawberry tests for 1894 appeared in Bulletin seventy-six, which is reprinted in this report.

**Forcing Vegetables.**—The Station greenhouses will be devoted this winter again to forcing vegetables, growing mushrooms and pot experiments with fertilizers.

These experiments in forcing vegetables for the winter market will alone well repay one interested in new departures in agriculture, to visit the Station and inspect the results which are being secured. Last winter between the 13th of December and the 26th of May, there was produced in the Station greenhouse, aggregating 148 feet in length by 20 feet wide, about 300 pounds of mushrooms, about 1,000 English cucumbers, over 400 pounds of tomatoes, about 120 dozen lettuce, over 100 dozen radishes, and 11,100 string beans. The mushrooms were grown under but a portion of the benches and produced at the rate of over 60 pounds per 100 square feet of the bed surface.

Many of these were actually sold at the following prices in the Geneva market: Mushrooms, \$1 per pound; English cucumbers, 50 cents each; string beans, 40 cents per hundred; lettuce, 40 cents per dozen; radishes, 4 cents per bunch; tomatoes, 50 cents per pound.

### **Station Work in the Second Judicial Department.**

The last Legislature appropriated \$8,000, to be expended under the direction of this Station, in agricultural investigations and the dissemination of agricultural knowledge in the Second Judicial Department of New York State, including the counties of Orange and Dutchess, and the counties southward, excepting New York. This work has been placed under the general direction of the Horticulturist, subject to the approval of the Station Director.

By special request of representative agriculturists of this section, the investigations undertaken the past season in accordance with provisions of this law, have been concerned with the insect pests of truck crops, and the testing of various kinds of machines for applying insecticides and fungicides. Some of the results of this work are published in the following bulletins: Bulletin No. 74 is entitled "Observations on the Application of Insecticides and Fungicides." No. 75 is on "Insects Injurious to Squash, Melons and Cucumber Vines; the Asparagus Beetle." No. 83 is on "Late Cabbage Insects." Other bulletins are in preparation.

The most important discovery that has been made by the entomologists, incidental to their work, is the presence of the San Jose scale, not found before within the limits of New York State. Mr. Howard, Entomologist of the United States Department of

Agriculture, states that it is known as the worst insect pest of deciduous fruit trees on the Pacific coast. In view of the serious nature of this new pest and the importance of preventing, if possible, its distribution to other parts of the State, it is proposed to test methods of fighting it during the coming winter and spring. Early spring will give the best opportunity for studying some of the most serious insect pests of field crops, namely, the asparagus beetle, onion magot and onion thrips, and early cabbage insects; also the cucumber and potato flea beetles and a dipterous larvæ affecting spinach, beets and probably other vegetables of similar nature. The summer's work will be a continuation, largely, of that begun in the spring, together with a special study of the squash vine borer, common melon louse and boreal lady-bird beetle, which is very destructive to squash and pumpkin vines.

The Mycologist began work December 1. At present he is studying diseases of considerable importance to florists. He will give his attention to other important fungus diseases of cultivated plants, as opportunity arises.

**Bulletins.**—The following bulletins pertaining to horticultural work have been issued during the year.

No. 64. I. Some experiments with strawberries in 1893.

II. Strawberry crosses.

No. 67. Experiments in preventing pear scab in 1893.

No. 69. Vegetables grown for exhibition.

No. 72. Preventing leaf blight of plum and cherry nursery stock.

No. 74. Observations on the application of fungicides and insecticides.

No. 76. Notes on strawberries for 1894.

No. 81. Variety tests with blackberries, dewberries and raspberries.—Raspberry anthracnose.

Nos. 64, 67, 69 and 72 were printed with some alterations in the annual report of 1893; Nos. 74, 76 and 81 appear in this volume.

**Addresses.**—The Horticulturist has addressed the following meetings during the year:

Farmers' institutes in New York State at Canastota, Fayetteville, Seneca Falls, Phelps, Penn Yan, Albion, Batavia, Mount

Kisco, Riverhead, Mineola, Dryden, Yorktown, Vernon, Madison and Knoxboro; Granges at Ovid Centre, N. Y., and Oaks' Corners, N. Y.; The Academy of Science, Elmira, N. Y.; The Western New York Horticultural Society, Rochester, N. Y.; Farmers' clubs at Syracuse, N. Y., and Trumansburg, N. Y.; Fruit Growers' Society, Medina, N. Y.; Niagara County Farmers' Society, Ransomville, N. Y.; New York State Fair, Syracuse, N. Y.; Chautauqua Grape-Growers' Association, Fredonia, N. Y.; annual meeting of the Ontario Fruit-Growers' Association, Orillia, Canada.

**Exhibitions.**—An extensive exhibit of fruit and vegetables was made at the State Fair, Syracuse, N. Y., and at the Hornellsville Fair.

## Variety Tests of Apples.

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The varieties of apples thus far received at this Station for testing have, with few exceptions, been topworked on young bearing trees of Baldwin or Rhode Island Greening. In a few cases they were topworked on some other variety and in several instances root-grafted or budded trees of the variety to be tested were planted. Many old varieties have been admitted to the orchards for the sake of comparison with the newer sorts.

This topworking of varieties received at the Station for testing was begun in 1883, and since then has been continued at intervals, till at the present time there are four hundred and nine kinds of apples and twenty-seven kinds of crab apples growing in the Station orchards, making a total of four hundred and thirty-six varieties.

Many of the kinds first introduced are now bearing from a few fruits to three or four bushels per tree. One hundred and fifty-two kinds of apples and fifteen kinds of crab apples were fruited here in 1894, making the total number of varieties fruited one hundred and sixty-seven. Notes on a few of these varieties are given below. It should be remembered that this report does not pretend to make a final statement as to the merits of these varieties, but simply shows their record thus far at this Station. Undoubtedly in some localities some of them will do better than they have done here; in other places they may not do so well as they have done here. As the trees become older, it will be possible to make more extended reports and to include new features that may be brought out by the data constantly accumulating in the Station's annual records.

Synonyms and temporary names of unnamed seedlings in the following pages are printed in italics.

## NOTES ON VARIETIES.

**Aport Oriental.**—A Russian apple, scions of which were received from T. H. Hoskins, Newport, Vt. Topworked on a bearing-tree in 1888, it bore its first crop of fruit this season. The apples are of medium size, roundish, oblate, conic; skin tough, pale yellowish green, sometimes with a faint blush, sprinkled with large white dots and covered with faint white bloom; stem medium, set in a deep russeted cavity; calyx small, closed, set in a small, shallow, slightly corrugated basin; flesh whitish, nearly sweet, not firm; core large; quality fair. Season, August.

**Autumn Streaked.**—A Russian apple, received from T. H. Hoskins, Newport, Vt. Topworked on a bearing tree in 1888. Fruit large, yellow or pale yellow, striped and splashed or shaded with red, and covered with pink bloom. The brilliancy of its coloring varies, some fruits being rather dull while others are bright and handsome. Stem rather stout, set in a narrow, shallow cavity; calyx large, closed, set in a wrinkled, uneven, wide basin; flesh firm, rather crisp, moderately juicy, sprightly subacid, good quality. Season, September.

Mr. T. T. Lyon, in Bulletin No. 2, U. S. Div. Pomology, 1888, p. 39, reports this variety as adapted to northern New York and northern New England. In these sections its season would probably be later than it is at Geneva.

**Buckingham.**—A southern apple of unknown origin, received from R. G. Chase & Co., Geneva, N. Y., in 1888, under the name of Winter Queen. The fruit is medium to large, oblate, yellow, blushed and mottled with red and carmine, whitish bloom; stem about an inch long, set in a broad, deep, slightly russeted cavity; calyx small, closed, set in a deep-ribbed basin, sometimes varying to shallow; flesh nearly white, crisp, juicy, mild, subacid, with distinct aroma: rather coarse; good flavor and quality. Season, December.

**Cox's Pomona.**—Scions of this variety were received from Ellwanger & Barry, in 1883. It bore its first fruit in 1892. It does not agree well with the description given by Downing.

Fruit is frequently large and highly colored with crimson on a clear, very pale yellow ground; cavity deep, stem rather short; calyx open, basin wide, somewhat corrugated; good to very good in quality. Season, October.

**Everbearing.**—*Illinois Imperial.*—Received from Benjamin Buckman, Farmingdale, Ill., and topworked on bearing tree in 1888; yielded its first specimens of fruit in 1893, and produced a light yield in 1894; fruit medium to large, roundish, oblate; skin smooth, yellow, lightly splashed with red in the sun and sprinkled with dots; calyx closed; stem rather short and slender; both cavity and basin are narrow and moderately deep; flesh crisp, juicy, sub-acid; good to very good. Began to ripen in 1894 about September 1.

**Excelsior Crab Apple.**—A seedling of Wealthy, originated by Peter M. Gideon, Excelsior, Minn., from whom it was received in 1888. Fruit very large for a crab, nearly as large as a medium-sized apple; roundish oblate; stem rather long and slender, sometimes bracted, and inserted in a narrow, rather shallow cavity; calyx rather large, closed, set in a shallow, broad plaited basin; skin smooth, yellow, sprinkled with numerous russet dots and shaded or splashed with red over much of its surface; handsome in appearance; flesh white, not fine grained, firm, juicy, subacid with crab apple flavor; good to very good in quality. Begins to ripen about the first of September. Tree vigorous, upright, spreading. Worthy of testing further.

**Gideon.**—This variety originated with Peter M. Gideon, Excelsior, Minn., from whom it was received in 1888. It was grafted on a bearing tree and bore its first fruit in 1892. The fruit is medium to large, nearly round; skin light yellow, without blush, waxy or oily to the touch; stem slender, set in a deep, irregular cavity; calyx small, closed, segments reflexed; basin medium; flesh white, juicy, crisp, nearly sweet, good in flavor and quality. Season, October. Tree a good grower.

**Gideon, No. 7.**—From Peter M. Gideon, Excelsior, Minn. Fruit of Oldenburg type, medium or above, roundish, oblate; stem slender, set in a deep, rather narrow cavity; calyx closed, segments reflexed, basin moderately wide and deep, somewhat

corrugated; skin smooth, pale yellow or green, splashed and shaded with red; flesh subacid, not so crisp and juicy as that of Oldenburg, but has more of a yellowish tinge. Better for dessert use than Oldenburg, and ripens about with that variety. It is not superior to other varieties of its season for dessert use, and is inferior to Oldenburg for culinary use, being more mild in flavor, therefore it does not seem to be worthy of introduction in the apple-growing sections of New York State.

**Groskoe Selenka Gruner.**—A Russian app'e received from Ellwanger & Barry, in 1883. It was topworked on a young tree and produced a small crop of fruit five years later. The tree is upright, inclined to spread, productive; young shoots slender, pale brown color, downy; fruit medium, ribbed, roundish, flattened; skin thin and tender, nearly white, slightly tinged with pink on the exposed side; calyx closed, segments reflexed, set in a narrow, shallow corrugated basin; stem rather long and slender, set in a narrow cavity; flesh firm, crisp, juicy, white, fair quality, but becomes water-cored and worthless if allowed to remain on the tree until fully ripe. Season, August.

**Hartford Rose.**—Topworked on a bearing tree in 1888, and bore its first fruit five years later. Fruit above medium, oblong conical; yellow, nearly covered with pale red, occasionally splashed with carmine and sprinkled with numerous pale dots; its color is not brilliant enough to be as attractive as other apples of its season. Stem rather long and slender, set in a deep, narrow cavity; calyx small, closed, set in a narrow, rather shallow basin; flesh nearly white, tender, fine-grained, moderately juicy, mild subacid, fine flavor, good quality. It is not equal to Mother as a dessert apple either in quality or appearance. It is excellent for culinary use. Season, September and first of October.

This variety was received from W. P. Rupert & Sons, Seneca, Ontario county, N. Y., who state that it originated as a seedling in Connecticut. About eighty years ago the man who owned the original tree brought scions of it to Seneca, N. Y., and grew the variety on the farm now owned by Messrs. Rupert. It was named by them, and, so far as they know, it has never been disseminated.

**Karaboff, *Karabovka Karabowka*.**—Received, here in 1884 from Messrs. Ellwanger & Barry,<sup>1</sup> Rochester, N. Y., under the name “Karabowka.” It is a Russian apple, which, according to Prof. Budd,<sup>1</sup> was imported by him from Moscow as No. 21m, and by the United States Department of Agriculture as No. 205. As grown here, it does not coincide with the description given by Prof. Budd in the place cited above.

As grown here, the fruit is medium in size, oblate, dull dark yellow, largely striped, splashed or shaded with red, and covered with pink bloom. Calyx pretty large, nearly closed, set in a wide basin. Stem rather slender, set in narrow, deep, often russeted, cavity. Skin smooth. Flesh nearly white, tender, mild subacid with peculiar flavor, fair quality. Begins to ripen about September first. Undesirable in this section.

**Late Duchess.**—Scions received from Peter M. Gideon, Excelsior, Minn., in 1888. The fruit resembles Oldenburg very closely, and ripens at about the same season as that variety, or a little earlier, ripening in August. It is not quite as brilliantly colored as the Oldenburg, the basin is not as deep and the flesh has a milder subacid flavor. The tree is much like the Oldenburg in habit of growth, being vigorous, upright and rather spreading. Since it is in no way superior to the well-known variety which it so much resembles, there seems to be no reason for planting it in this locality.

**Longfield, No. 161.**—A Russian apple imported by the Department of Agriculture. Scions were received in 1888 from T. H. Hoskins, Newport, Vt. Fruit medium, roundish, slightly narrowed toward either end; calyx medium, partially open, segments reflexed; basin shallow, irregular; stem small, set in a narrow cavity; skin smooth, pale greenish yellow, lightly blushed with bright red in the sun; flesh white, crisp, subacid, moderately juicy, fine grained; quality very good. Season here, middle of September to middle of October.

**No. 238 Department.**—A Russian apple of United States Department of Agriculture importation, received in 1888 from Merrill, Anthony & Co., and topworked on a bearing tree. This

<sup>1</sup> Northeast Europe Fruits, Bulletin of Iowa Agricultural College, Ames, Iowa, 1885, p. 7.

was incorrectly referred to in the Station's annual report for 1892 as No. 225, and in the annual report for 1893 as No. 226. The fruit is medium to large, oblate, irregular, obscurely ribbed, inclined to conic; skin greenish yellow, shaded and faintly striped with crimson on the exposed side, and sprinkled with light dots; stalk short, small, inserted in a deep russeted cavity; calyx closed, set in a medium, irregular basin; flesh whitish, nearly sweet, moderately firm, fair to good in quality. Season, August.

**Ostrakoff.**—Received here from Messrs. Ellwanger & Barry, Rochester, N. Y., under the name *Astravaskoe*. Prof. Budd described it in 1885<sup>1</sup> under the name of "Ostrakoff's Glass," and in 1890<sup>2</sup> under the name Ostrakoff. It was planted here in 1884, and bore a few fruits four years later. This year its fruit began to drop as early as September 1, and before the end of the month it had nearly all fallen. Season here this year, September and October, but it should be stated that apples generally did not keep well this year. Prof. Budd describes it as a winter variety in central Iowa, and says that at the north limits of its growth it keeps till May. It may be, as claimed, a hardy tree, and desirable for the northern limits of the apple belt, but it can not be recommended for sections where old standard varieties succeeded.

Size medium to large, oval or conic, yellow, and having numerous dots. Stem rather short and slender. Cavity narrow and deep. Calyx prominent, nearly closed. Basin wide, abrupt, corrugated. Flesh firm, breaking, moderately juicy, agreeable subacid, good flavor and good quality.

**Red Beitigheimer.**—Fruit very large, roundish, with short, deep-set stalk, closed calyx and large, deep basin. Skin pale yellow, mostly covered with pale crimson. A magnificent fruit for exhibition, but it is so large that it drops badly before ripe. A tree of this variety in one of the Station orchards had, as estimated the last of August, a crop of three bushels, but before the fruit had ripened nearly all the apples had dropped from the tree. The fruit should be picked before it is ripe or fully colored. Season here extends into October.

<sup>1</sup> Bulletin Iowa Agricultural College, 1885, *East Europe Fruits*, p. 26.

<sup>2</sup> Bulletin Iowa Agricultural College, 1890, *Revised Notes on Pears, Cherries, etc.*, p. 23.

**Red Transparent.**—A Russian variety of no value here where Primate is readily grown. Fruit medium, with pale skin nearly covered with red and with a delicate bloom. Basin irregular and corrugated, calyx prominent and closed. Flesh greenish white, not crisp, watercores badly.

**Repka.**—A Russian apple. Fruit medium size, roundish oblate inclined to conic; skin pale yellow; stem rather short, set in a deep cavity; calyx closed, set in a wide corrugated basin; flesh white, fine-grained, juicy, rather mild subacid, good quality. Began to ripen about the 1st of September this season.

**Titovka.**—Scions received from Ellwanger & Barry in 1883. It was topworked on a bearing tree, and bore its first fruit five years later. The tree is vigorous and of an upright-growing habit. The fruit is large, oblong, tapering to the eye, slightly angular; skin smooth, light green, handsomely shaded and striped with bright red and covered with a slight bloom; stem short, deeply set, hardly projecting beyond the deep cavity; calyx closed, set in a deep, slightly corrugate basin; flesh white, coarse, subacid; very good for culinary use. Season, August and early September. On account of its large size and handsome color it would probably prove to be a good market apple.

**Whitney, No. 20, crab apple.**—Received in 1889 from The Pike County Nurseries, Louisiana, Mo. Fruit large, roundish, slightly flattened; skin light yellow, beautifully shaded and tinted with red; calyx medium, closed; basin broad, shallow and corrugated; stem slender, rather deeply inserted in the narrow cavity; flesh yellowish, nearly sweet, with a slight crab-apple flavor; quality good to very good. Season, last of August to first of September.

**Yellow Calville.**—*Voronesh No. 21, No. 442 Department.* This is a Russian apple imported by the United States Department of Agriculture. It was received here in 1888 from Dr. T. H. Hoskins, Newport, Vt. Fruit medium or below, oblate, somewhat irregular; skin smooth, pale yellow; calyx closed, set in a shallow, slightly corrugated basin; stem slender, cavity moderately deep; flesh white, fine-grained, tender, moderately juicy, subacid, fair quality. Season, last of August.

**YIELD OF APPLES IN 1894.**

The following table compares the yield of the different varieties of apples in Station Orchard No. 2 that fruited at the Station in 1894, shows the orchard age of the trees and at the same time indicates which of the trees were planted and which were top-worked on bearing stock. Since the trees are not all of the same orchard age, and since many varieties are just beginning to bear, the orchard age of each variety is given in the following table for the sake of comparison, and the yield is stated by using the adjectives, "few," "fair," "good," "large" or "very large," as the case may be :

TABLE SHOWING (1) YIELD OF APPLES IN 1894; (2) NUMBER OF YEARS SINCE EACH VARIETY WAS TOPWORKED ON A YOUNG BEARING TREE, OR SINCE IT WAS PLANTED, AND (3) SEASON OF RIPENING AT GENEVA.

NOTE.—The following abbreviations are used to denote the season of ripening: E. S., for early summer; E. F., for early fall; F., for fall; E. W., for early winter; W., for winter; L. W., for late winter and spring. Synonyms are printed in italics.

NAME.	Yield in 1894.	Years since topworked on bearing tree.	Years since tree was planted.	Season at Geneva.
Acuba-leaf Reinette .....	Fair .....	11	....	E. W.
Alexander .....	Good .....	11	....	F.
Amasia .....	Good .....	11	....	W.
<i>American Newtown Pippin</i> , see Green Newtown Pippin .....	.....	.....	.....	.....
Amos Jackson .....	Few .....	5	....	E. W.
<i>Aporta</i> , see Alexander .....	.....	.....	.....	.....
Ananarnoe .....	Few .....	10	....	F.
Andrew's Winter .....	Few .....	5	....	L. W.
Aport Oriental .....	Fair .....	6	....	F.
<i>Astravaskoe</i> , see Ostrakoff .....	.....	.....	.....	.....
August .....	Fair .....	6	....	S.
Aunt Ginnie .....	Few .....	11	....	F.
<i>Aurora</i> , see Twenty Ounce .....	.....	.....	.....	.....
Autumn Streaked .....	Fair .....	6	....	F.
Baldwin .....	.....	11	....	W.
<i>Baltimore Pippin</i> , see Ben Davis ..	.....	.....	.....	.....
<i>Baltimore Red</i> , see Ben Davis .....	.....	.....	.....	.....
<i>Baltimore Red Streak</i> , see Ben Davis ..	.....	.....	.....	.....
Belborodooskoe. ....	Fair .....	9	....	S.
Belle de Boskoop .....	Few .....	6	....	E. W.
<i>Belle Fleur</i> , see Yellow Bellflower ..	.....	.....	.....	.....
<i>Bell's Early</i> , see Sops of Wine .....	.....	.....	.....	.....
Ben Davis .....	Fair .....	10	....	L. W.
Benninger .....	Few .....	5	....	F.
<i>Bennington</i> , see Sops of Wine .....	.....	.....	.....	.....
<i>Boston Russet</i> , see Roxbury Russet ..	.....	.....	.....	.....
<i>Brooke's Pippin</i> , see Green Newtown Pippin .....	.....	.....	.....	.....
Buckingham .....	Good .....	6	....	W.
<i>Buckley</i> , see Chenango Strawberry ..	.....	.....	.....	.....
<i>Byer's Best</i> , see Buckingham .....	.....	.....	.....	.....
Carolina June .....	Large .....	11	....	S.
<i>Carolina Red Streak</i> , see Ben Davis ..	.....	.....	.....	.....
<i>Cayuga Red Streak</i> , see Twenty Ounce .....	.....	.....	.....	.....

TABLE SHOWING THE YIELD OF APPLES, ETC., IN 1894 — (*Continued*).

NAME.	Yield in 1894.	Years since topworked on bearing tree.	Years since tree was planted.	Season at Geneva.
Chenango Strawberry .....	Large .....	11	.....	S.
<i>Coleman</i> , see Twenty Ounce .....	.....	.....	.....	.....
Colton .....	Few .....	6	.....	.....
Coon's Red .....	Few .....	5	.....	W.
Cooper's Market .....	Large .....	11	.....	W.
<i>Cooper's Redling</i> , see Cooper's Market .....	.....	.....	.....	.....
Count Orloff .....	Fair .....	9	.....	E. S.
Cox's Pomona .....	Few .....	11	.....	E. F.
Czar's Thorn .....	Fair .....	9	.....	E. F.
Dickinson .....	Fair .....	6	.....	W.
<i>Dodge's Early Red</i> , see Sops of Wine .....	.....	.....	.....	.....
Dominie .....	Good .....	11	.....	W.
Downing's Winter Maiden's Blush .....	Few .....	7	.....	W.
<i>Duchess of Oldenburg</i> , see Oldenburg .....	.....	.....	.....	.....
Duke of Devonshire .....	Good .....	11	.....	L. W.
Dumelow .....	Large .....	11	.....	W.
Duncan .....	Few .....	5	.....	L. W.
<i>Early French Reinette</i> , see Early Harvest .....	.....	.....	.....	.....
Early Harvest .....	Good .....	11	.....	E. S.
<i>Emperor Alexander</i> , see Alexander .....	.....	.....	.....	.....
<i>English Golden</i> , see Golden Russet .....	.....	.....	.....	.....
<i>English Golden Russet</i> , see Golden Russet .....	.....	.....	.....	.....
<i>English Pippin</i> , see Longfield .....	.....	.....	.....	.....
<i>Ernst's Pippin</i> , see Ohio Pippin .....	.....	.....	.....	.....
Esopus Spitzenburg .....	Few .....	10	.....	W.
Etowah .....	Few .....	5	.....	.....
Everbearing .....	Few .....	5	.....	F.
Ewalt .....	Few .....	6	.....	W.
Fallwater .....	Very large .....	11	.....	W.
Fall Pippin .....	Good .....	11	.....	F.
<i>Fall Queen</i> , see Haas .....	.....	.....	.....	.....
<i>Fall Queen</i> , see Buckingham .....	.....	.....	.....	.....
Fall Wine .....	Few .....	11	.....	F.
Fameuse .....	Very large .....	11	.....	F.
<i>Faust's Rome Beauty</i> , see Rome Beauty .....	.....	.....	.....	.....
Flory .....	Few .....	5	.....	.....
<i>Frank</i> , see Chenango Strawberry .....	Large .....	5	.....	F.

TABLE SHOWING THE YIELD OF APPLES, ETC., IN 1894 — (*Continued*).

NAME.	Yield in 1894.	Years since topworked on bearing tree.	Years since tree was planted.	Season at Geneva.
<i>Gardener's Apple</i> , see Mother .....				
Gideon .....	Fair .....	6 .....		F.
Gideon No. 3, Sweet .....	Fair .....	6 .....		S.
Gideon No. 7 .....	Fair .....	6 .....		S.
<i>Gillett's Seedling</i> , see Rome Beauty .....				
Golden Russet .....	Good .....	11 .....		L. W.
Golden Sweet .....	Good .....	11 .....		E. F.
Golden White .....	Few .....	6 .....		F.
Grand Duke Constantine .....	Large .....	10 .....	10	S.
Grand Sultan .....	Very large .....			E. S.
Gravenstein .....	Large .....	11 .....		F.
<i>Gray Apple</i> , see Pomme Grise .....				
Green Newtown Pippin .....	Good .....	11 .....		L. W.
<i>Green Winter Pippin</i> , see Green Newtown Pippin .....				
<i>Green Vandervere</i> , see Vandervere .....				
Grimes' Golden .....	Few .....	6 .....		E. W.
Groskoe Selenka Gruner .....	Large .....	11 .....		E. S.
<i>Gros Pomier</i> , see Haas .....				
Haas .....	Large .....	11 .....		F.
Haskell Sweet .....	Few .....	6 .....		
Hartford Rose .....	Fair .....	6 .....		F.
Holland .....	Few .....	6 .....		E. W.
<i>Holland Pippin</i> , see Holland .....				
<i>Hominy</i> , see Sops of Wine .....				
<i>Hoss</i> or <i>Horse</i> , see Haas .....				
<i>Howe</i> or <i>House</i> , see Fall Wine .....				
<i>Howe's Russet</i> , see Roxbury Russet .....				
Hubbardston Nonesuch .....	Very large .....		8	E. W.
Hurlbut .....	Very large .....	10 .....		W.
<i>Hurlbut Stripe</i> , see Hurlbut .....				
<i>Jackson Apple</i> , see Chenango .....				
Strawberry .....				
Jacobs Sweet .....	Few .....	6 .....		L. W.
Jeffries .....	Large .....	11 .....		S.
<i>Jeniton</i> , see Rawle's Janet .....				
<i>Jenette</i> , see Rawle's Janet .....				
Jersey Sweeting .....	Very large .....	11 .....		S.
Jewett's Fine Red .....	Fair .....	6 .....		L. W.
Jonathan .....	Few .....	6 .....		W.

TABLE SHOWING THE YIELD OF APPLES, ETC., IN 1894 — (Continued).

NAME.	Yield in 1894.	Years since top-worked on bearing tree.	Years since tree was planted.	Season at Geneva.
Juicy Krimtartar.....	Few .....	6 .....	.....	F.
<i>July Apple</i> , see Primate .....	.....	.....	.....	.....
<i>July Pippin</i> , see Early Harvest.....	.....	.....	.....	.....
Kalkidouskoe .....	Few .....	10 .....	.....	F.
Karabowka .....	Few .....	10 .....	.....	S.
<i>Kentucky Pippin</i> , see Ben Davis....	.....	.....	.....	.....
<i>Kentucky Queen</i> , see Buckingham ..	.....	.....	.....	.....
Keswick .....	Large .....	11 .....	.....	E. F.
<i>King Apple</i> , see King of Tompkins County .....	.....	.....	.....	.....
King of Tompkins County.....	Good .....	11 .....	.....	E. W.
Kittageskee .....	Few .....	5 .....	.....	L. W.
Lady .....	Large .....	11 .....	.....	W.
Lady Henniker .....	Good .....	11 .....	.....	L. W.
Lady Sweet.....	Good .....	11 .....	.....	L. W.
Landsberger Reinette.....	Few .....	6 .....	.....	W.
Lankford.....	Few .....	6 .....	.....	W.
<i>Large White Juneating</i> , see Early Harvest .....	.....	.....	.....	.....
Late Duchess.....	Fair .....	6 .....	.....	S.
<i>Lima</i> , see Twenty Ounce.....	.....	.....	.....	.....
Longfield .....	Good .....	6 .....	.....	E. W.
Lou .....	Fair .....	6 .....	.....	F.
<i>Lyman's Pumpkin Sweet</i> , see Pumpkin Sweet.....	.....	.....	.....	.....
Magog Red Streak.....	Few .....	6 .....	.....	.....
Maiden Blush .....	Good .....	11 .....	.....	F.
<i>Marietta Russet</i> , see Roxbury Russet .....	.....	.....	.....	.....
<i>Maryland Queen</i> , see Haas.....	.....	.....	.....	.....
McMahan's White .....	Few .....	6 .....	.....	W.
Melon .....	Few .....	11 .....	.....	F.
Melonen .....	Few .....	6 .....	.....	S.
Milligen .....	Few .....	6 .....	.....	.....
<i>Molly Whopper</i> , see Fallawater.....	.....	.....	.....	.....
Monmouth .....	Good .....	11 .....	.....	W.
<i>Morgan's Favorite</i> , see Twenty Ounce .....	.....	.....	.....	.....
Mother .....	Very large ..	11 .....	.....	E. W.
<i>Mountain Pippin</i> , see Fallawater....	.....	.....	.....	.....
<i>Musk Spice</i> , see Fall Wine.....	.....	.....	.....	.....

TABLE SHOWING THE YIELD OF APPLES, ETC., IN 1894 — (Continued).

NAME.	Yield in 1894.	Years since imported on bearing tree.	Years since tree was planted.	Season at Geneva.
Nelson's Sweet.....	Fair .....	5 .....	.....	W.
<i>Never Fail</i> , see Rawle's Janet.....	.....	.....	.....	.....
<i>Newtown Pippin</i> , see Green New- town Pippin.....	.....	.....	.....	.....
<i>New Brunswick</i> , see Oldenberg.....	.....	.....	.....	.....
<i>Newman's Seedling</i> .....	Few .....	4 .....	.....	L. W.
<i>New York Pippin</i> , see Ben Davis....	.....	.....	.....	.....
<i>Nodhead</i> , see Jewett's Fine Red.....	.....	.....	.....	.....
<i>North American Best</i> , see Primate..	.....	.....	.....	.....
Northern Spy.....	Large .....	11 .....	.....	L. W.
Northwestern Greening.....	Fair .....	6 .....	.....	L. W.
<i>Norton's Melon</i> , see Melon.....	.....	.....	.....	.....
No. 21, <i>Voronesh</i> , see Yellow Cal- ville.....	.....	.....	.....	.....
No. 161m, <i>Russian</i> , see Birth.....	.....	.....	.....	.....
No. 238.....	Few .....	6 .....	.....	S.
No. 477, <i>Dept. Russian</i> , see Birth....	.....	.....	.....	.....
Occident.....	Large .....	11 .....	.....	L. W.
Ohio Pippin.....	Few .....	6 .....	.....	E. W.
Oldenburg .....	Good .....	11 .....	.....	S.
<i>Ohio Wine</i> , see Fall Wine.....	.....	.....	.....	.....
Ontario.....	Large .....	11 .....	.....	L. W.
Ornament de Table .....	Few .....	5 .....	.....	F.
Ostrakoff .....	Few .....	10 .....	.....	E. F.
<i>Palmer's Greening</i> , see Washington Royal .....	.....	.....	.....	.....
Parry White .....	Few .....	5 .....	.....	E. F.
Peck's Pleasant.....	Good .....	11 .....	.....	W.
Peter.....	Few .....	6 .....	.....	W.
<i>Petersburg Pippin</i> , see Green New- town Pippin .....	.....	.....	.....	.....
Pewaukee.....	Large .....	11 .....	.....	W.
Pomme Grise.....	Good .....	11 .....	.....	E. W.
<i>Pommeroy</i> , see Lady's Sweet.....	.....	.....	.....	.....
<i>Pound</i> , see Fallawater .....	.....	.....	.....	.....
<i>Pound Sweet</i> , see Pumpkin Sweet....	.....	.....	.....	.....
* <i>Powers</i> , see Primate.....	.....	.....	.....	.....
Primate .....	Fair .....	11 .....	.....	E. S.
<i>Prince's Harvest</i> , see Early Harvest..	.....	.....	.....	.....
Princess Louise .....	Few .....	6 .....	.....	E. W.
<i>Prussian</i> , see Twenty Ounce .....	.....	.....	.....	.....

TABLE SHOWING THE YIELD OF APPLES, ETC., IN 1894 — (Continued).

NAME.	Yield in 1894.	Years since topworked on bearing tree.	Years since tree was planted.	Season at Geneva.
Pumpkin Russet .....	Few .....	11	.....	F.
Pumpkin Sweet .....	Good .....	11	.....	F.
Putnam Russet, see Roxbury Russet .....	.....	.....	.....	.....
Queen Ann, see Mother .....	.....	.....	.....	.....
Queen, see Buckingham .....	.....	.....	.....	.....
Rambo .....	Fair .....	11	.....	L. W.
Rawle's Janet .....	Very large .....	11	.....	W.
Red Astrachan .....	Good .....	11	.....	E. S.
Red Beitigheimer .....	Large .....	11	.....	F.
Red Cheek Pippin, see Monmouth .....	.....	.....	.....	.....
Red Pippin, see Ben Davis .....	.....	.....	.....	.....
Red Russet .....	Very large .....	11	.....	L. W.
Red Transparent .....	Few .....	10	.....	F.
Red Vandervere, see Vandervere .....	.....	.....	.....	.....
Reinette a feuille d'Acuba, see Acuba-leaf Reinette .....	.....	.....	.....	.....
Reinette de Caux .....	Very large .....	11	.....	W.
Repka .....	Few .....	10	.....	E. F.
Reschestsenskoe, see Birth .....	.....	.....	.....	.....
Rhode Island Greening .....	Large .....	11	.....	W.
Rhodes' Orange .....	Good .....	5	.....	L. W.
Rome Beauty .....	Large .....	11	.....	L. W.
Romna .....	Few .....	5	.....	E. F.
Roxbury Russet .....	Good .....	11	.....	W.
St. Peter's .....	Few .....	6	.....	S.
Sankermanky .....	Few .....	6	.....	.....
Scott's Winter .....	Few .....	6	.....	L. W.
Sharp .....	Few .....	5	.....	W.
Small's Admirable .....	Large .....	11	.....	F.
Smith's Cider .....	Few .....	6	.....	L. W.
Sops of Wine .....	Fair .....	11	.....	F.
Stanard .....	Fair .....	5	.....	F.
Stump .....	Fair .....	11	.....	F.
Sutton's Beauty .....	Few .....	11	.....	W.
Swaar .....	Few .....	6	.....	L. W.
Switzer .....	Few .....	6	.....	E. F.
Talman Sweet .....	Large .....	11	.....	W.
Tetofsky .....	Good .....	11	.....	S.
Thaler .....	Fair .....	6	.....	F.
Titovka .....	Good .....	11	.....	F.
Tufts .....	Good .....	11	.....	W.
Twenty Ounce .....	Few .....	11	.....	F.
Vandervere .....	Large .....	11	.....	W.

TABLE SHOWING THE YIELD OF APPLES, ETC., IN 1894 — (*Continued*).

NAME.	Yield in 1894.	Years since topworked on bearing tree.	Years since tree was planted.	Season at Geneva.
Wagener .....	Very large..	11	.....	L. W.
Walbridge .....	Fair .....	6	.....	L. W.
<i>Washington</i> , see Sops of Wine .....	.....	.....	.....	.....
Washington Royal .....	Good .....	6	.....	L. W.
Washington Strawberry .....	Fair .....	6	.....	S.
Wealthy .....	Fair .....	6	.....	F.
Western Beauty .....	Few .....	6	.....	W.
White Pigeon .....	Few .....	6	.....	S.
White Pippin .....	Very large..	11	.....	L. W.
<i>White Vandervere</i> , see Vandervere..	.....	.....	.....	.....
<i>Well's</i> , see Dominie .....	.....	.....	.....	.....
<i>William's Early</i> , see William's Favor- ite .....	.....	.....	.....	.....
William's Favorite .....	Good .....	11	.....	E. S.
<i>William's Red</i> , see William's Favor- ite .....	.....	.....	.....	.....
William Prince .....	Fair .....	6	.....	S.
Winesap .....	Large .....	11	.....	W.
<i>Winter Blush</i> , see Fallawater .....	.....	.....	.....	.....
<i>Winter Queen</i> , see Buckingham .....	.....	.....	.....	.....
Wolf River .....	Few .....	6	.....	.....
Workaroe .....	Few .....	11	.....	W.
Yellow Bellflower .....	Large .....	11	.....	W.
Yellow Calville .....	Fair .....	6	.....	S.
Yellow Forest .....	Few .....	6	.....	L. W.
Yellow Transparent .....	Large .....	6	.....	E. S.
York Imperial .....	Large .....	6	.....	W.

Total varieties of apples fruited, 155.

TABLE SHOWING THE YIELD OF APPLES, ETC., IN 1894 — (*Concluded*).

NAME.	Yield in 1894.	Years since topworked on bearing tree	Years since tree was planted.	Season at Geneva.
<b>CRAB APPLES.</b>				
Cherry Red .....	Good .....	.....	5	S.
Chicago .....	Good .....	6	.....	W.
Coral .....	Good .....	11	.....	E. W.
Dartmouth .....	Few .....	6	.....	S.
Excelsior .....	Fair .....	6	.....	M. F.
Hyslop .....	Very large..	11	.....	F.
Large Red Siberian .....	Few .....	6	.....	E. F.
Marengo .....	Few .....	6	.....	.....
Martha .....	Few .....	6	.....	E. F.
Montreal Beauty .....	Few .....	6	.....	F.
Oblong .....	Fair .....	11	.....	E. F.
Paul's Imperial .....	Good .....	6	.....	E. F.
Red Siberian .....	Few .....	6	.....	E. F.
Transcendant .....	Fair .....	11	.....	F.
Whitney No. 20 .....	Very large..	11	.....	S.
Yellow Siberian .....	Few .....	6	.....	S.

Total varieties of crab apples fruited, 16.

## Variety Tests of Blackberries.

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The following pages are devoted to a brief account of the blackberries grown on the Station plots in 1894. Full descriptions of the varieties that fruited in 1893 were given in Bulletin No. 63 and in the annual report of this Station for 1893, either of which may be had on application. In this report only those varieties are described that are new, or that have fruited at this Station for the first time this season.

### BLACKBERRIES—NOTES ON VARIETIES.

**Early King.** (*From Ellwanger & Barry, Rochester, N. Y., 1892.*) Canes moderately vigorous, purplish red when mature; prickles long and abundant. Berries medium or above, roundish, with medium-sized grains. Fruit nearly sweet and of fair flavor and quality. Ripens very early.

**Fruitland.** (*From W. N. Scarff, New Carlisle, O., 1892.*) Canes strong, upright, with greenish red bark; prickles moderately abundant. Fruit medium, nearly round, with medium to large grains, sweet, good quality, and very good flavor.

**Ford's No. 1.** (*From Frank Ford & Son, Ravenna, O., 1892.*) Canes rather large but not thrifty, upright, with dull red or greenish bark, and few prickles. Fruit medium with medium to large grains; roundish, subacid, coarse core and poor quality.

**Mersereau's Seedling.** (*From J. M. Mersereau, Cayuga, N. Y., 1893.*) Berries roundish, medium size, with medium grains; somewhat seedy, nearly sweet, fair quality.

**Ohmer.** (*From N. H. Albaugh, Tadmire, O., 1892.*) Canes rather coarse and have but few prickles. Berries above medium, roundish, with large grains and coarse core. Fruit subacid, juicy, fair flavor and quality. This berry gives promise of being very productive.

**Reyner.** (*From S. R. Alexander, Bellefontaine, O., 1892.*) Plants rather large and vigorous, producing large greenish canes with few prickles. Fruit above medium, roundish or oblong, with large grains, sweet, good flavor and quality.

**Success.** (*From L. W. Carr & Co., Erie, Pa., 1892.*) This is one of the most productive blackberries that fruited here for the first time this season. Plants moderately vigorous; canes of a greenish color bearing abundant prickles. Berries medium to large, roundish, with medium to large grains; good in flavor and quality.

**Woodland.** (*From W. H. Phillips, Stanton, Ind., 1892.*) Plants thrifty, with abundant small prickles. Fruit medium or above; berry roundish with large to very large grains; pleasant flavor and good quality. Very productive as grown here this season.

#### YIELD OF BLACKBERRIES, 1894.

In the following table the yield of the blackberries that fruited at this Station in 1894 is given, together with the season of each variety. Five hills of each were originally set but they have been allowed to grow together so that the yield given is for the matted row. No protection is given the plants, so many of the more tender varieties have been winter killed. In such cases, the yield of the remaining plants is given. The date of planting should be taken into consideration when comparing varieties.

TABLE I—YIELD OF BLACKBERRIES, 1894.

Rank as to yield.	When set.	NAME.	Total Yield. Ounces.	In marketable condition.	
7	1888	Agawam .....	110	July	23 to September 1
12	1889	Ancient Briton .....	86	"	25 "
13	1888	Barnard .....	83	"	23 to August
4	1890	Carlo .....	126	"	23 "
10	1889	Dorchester .....	99	"	23 "
19	1889	Early Cluster .....	23	"	13 to July
6	1889	Early Harvest .....	113	"	23 to September 1
3	1888	Early Mammoth (Thompson's) .....	149	"	20 "
16	1892	Eldorado .....	44	"	23 "
1	1888	Evergreen, <i>Oregon Evergreen</i> .....	381	August 14	"
		<i>Jewett</i> , see Lovett.			
		<i>Lawton</i> , see New Rochelle.			
14	1888	Lincoln .....	70	"	23 "
9	1890	Lovett, <i>Jewett</i> .....	104	"	28 "
17	1891	Luther .....	32	"	23 "
11	1889	Minnewasaki .....	89	"	23 "
5	1889	New Rochelle, <i>Lawton</i> .....	120	"	23 "
		<i>Oregon Evergreen</i> , see Evergreen.			
11	1888	Snyder .....	89	"	20 to August
15	1888	Stone's Hardy .....	65	"	28 "
2	1888	Taylor, <i>Taylor Prolific</i> .....	197	"	20 to September 1
		<i>Thompson's Early Mammoth</i> , see Early Mammoth.			

7	1889	Wachusett.....	110	"	23 to August	11
20	1888	Wilson's Early.....	2	"	18 to July	25
8	1888	Wilson Junior.....	109	"	20 to August	18

The Evergreen was the most productive blackberry fruited here this season. During previous winters the canes have been severely winter killed, but last winter they were not affected by the cold. This variety was noted in the Report for 1893 as bearing fruit of very inferior quality, and this season's experience only tends to confirm our former opinion. The next in rank is Taylor. It was very unproductive in 1893; its fruit is small in size, but of good quality. Early Mammoth which is third on the list was not hurt as much by cold as it has been during previous winters. Its fruit is quite liable to be imperfect and knotty as was noted last year.

The fruit and the habit of growth of Early Mammoth and Wilson Junior are much alike. The canes are low and drooping, and bear larger and more attractive berries than many of the upright growing kinds. The plants are not perfectly hardy, but their drooping habit makes them easy to protect in winter. These varieties are very desirable, where they can be grown, on account of the size and quality of the fruit. For this reason it would be well to experiment with them, in a small way at first, to see if they could be made to pay as a commercial crop by giving them winter protection. Bending the canes to the ground and covering them lightly with earth has been found to be a cheap and effective method of protection. Carlo ranks fourth in productiveness. It has not been productive here in previous years. The fruit is of inferior quality and is suitable for neither home or market use. Dorchester was the most productive variety fruited here in 1893; the large crop of last season may have been the cause of its small yield this year.

#### LIST OF BLACKBERRIES SET IN SPRING OF 1894.

Childs Everbearing Tree. From J. L. Childs, Floral Park, N. Y.

Western Triumph. From R. M. Kellogg, Ionia, Mich.  
Sanford. From C. W. Graham, Afton, N. Y.

## Variety Tests of Dewberries.

The dewberries are much inferior to blackberries, as grown here, in both flavor and quality but on warmer, lighter soils they are sweet and good flavored. Their large size and attractive appearance will find them a place on the early market. They are very prolific bearers, and begin to ripen their fruit 10 days or more earlier than the blackberries. The vines are very easily winter killed, but are easily protected by throwing a few shovelfuls of earth on them as they lie prostrate on the ground. In the spring the vines should be tied up to a trellis or to stakes, while the new growth is left to trail on the ground, where it remains till it is tied to the trellis the following spring. A convenient form of trellis is made by stretching three wires over the rows, one above the other and about 15 inches apart. When tied up in this manner the fruit is much easier to pick and injury from contact with the ground is avoided.

**Bartel.** (*From F. Ford & Son, Ravenna, O., 1888.*) This variety is not identical with the Mammoth as grown here. Vines not as vigorous as Mammoth. The fruit resembles that variety, but is usually more compact and of a duller color; grains irregular in size, subacid, poor quality.

**Lucretia.** (*From F. Ford & Son, Ravenna, O., 1888.*) Vines moderately vigorous. Fruit generally smaller than Mammoth with a smaller core; grains large, juicy, subacid, poor quality.

**Mammoth.** (*From F. Ford & Son, Ravenna, O., 1888.*) Vines moderately vigorous. Fruit round or oblong, large size, with very large grains, juicy, subacid, poor quality.

TABLE II—YIELD OF DEWBERRIES, 1894.

Rank as to yield.	When set.	NAME.	Yield of row 20 feet long.	In marketable condition.
			Ounces.	
3	1888	Bartel.....	105	July 10 to August 4.
1	1888	Lucretia.....	253	July 10 to August 11.
2	1888	Mammoth.....	147	July 10 to August 6.

The Lucretia is the most productive of the three varieties and has the longest fruiting period.

Latimer's Seedling dewberry from J.W. Latimer, Pleasanton, Kan., was received for testing in the spring of 1894.

#### JAPANESE WINEBERRY.

The Japanese wineberry has been extensively advertised for several years past as a desirable novelty, so it is thought that a brief account of its behavior in this locality will not be out of place here. Plants of this fruit were received in 1892 from R. G. Chase & Co., Geneva, N. Y. They have made a good growth but are only moderately hardy. The canes are covered with a dense growth of long purple bristles which gives them a striking appearance. The fruit is borne in clusters similar to raspberries; as soon as the blossoms fall the long hairy segments of the calyx close over the ovaries, and so remain until the fruit begins to ripen when they recurve and expose the translucent wine colored berries. The light orange color of the inside of the sepals forms a pleasing contrast to the darker colored fruit. The berries are of medium size compared with raspberries, and crumble very badly. They are sprightly, mild subacid but inferior in quality to raspberries, as grown here. The plants have not been even moderately productive as yet. They are propagated by tips.

## Variety Tests of Grapes.

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Some of the newer varieties of grapes which have fruited in the Station vineyards are described below; comment is also made on a few older and better known grapes, and references are given to the reports of varieties which have been noted in previous publications of this Station.

The botanical classification of a variety is indicated by an italicised abbreviation of the name of the species to which it belongs.<sup>4</sup>

A hybrid is indicated by an "X" separating the names of the species of which it is the offspring, thus, *vin. X Lab.* indicates a hybrid of *vinifera* fertilized by *Labrusca*. When it is known to which of the two species the female parent belongs, this parent is named first.

When a hybrid is more closely related to one species than to any other this relationship is indicated by an "X" following the name of the species to which it is most closely related; thus, "*Lab. X*" shows that the hybrid is most closely related to the *Labrusca* species.

The names of the species represented in a hybrid are also frequently given in parentheses following the name of the hybrid; thus, Bailey, (*Lab., Lin., vulp.*) indicates that the three species named are represented in the parentage of this variety; Brighton, *Lab. X, (Lab., Vin.)* indicates that Brighton is a hybrid of *Labrusca* and *vinifera*, with more of *Labrusca* than of *vinifera* blood.

Synonyms are printed in italics and inclosed in parentheses.

**Blanco.** *Lab. X, (Lab., vul., vin.)*. A seedling of Elvira by Triumph. Cluster medium size, cylindrical, loose; berry medium,

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<sup>4</sup>The following abbreviations are used, viz.: *Lab.* for *Labrusca*, L. the wild Fox grape; *vulp.* for *vulpina*, L. (*riparia*, of Mx.), the wild grape of the river banks; *cand.* for *candicans* Engel., the Mustang grape of Texas; *æst.* for *æstivalis*, Mx., the wild Summer grape; *vin.* for *vinifera*, L., the cultivated grape of Europe; *Lín.* for *Linccumit*, Buck., the Post-oak grape of Texas; *Bourq.* for *Bourquiniana*, Mun., and *rup.* for *rupestris*, Scheele, the Rock or Sand grape of Western Mississippi Valley and Texas.

oval, purplish red or purple, covered with blue bloom; pulp moderately tender, not readily releasing the seeds. Moderately juicy, somewhat vinous, sweet, good flavor, good to very good quality. Not remarkably attractive in appearance. Season about with Concord. Vine unproductive. Blossoms incapable of setting fruit when self-fertilized, and therefore the vine should be mingled with other varieties that blossom at the same time. See no reason for its introduction into this section of the country.

**Chautauqua.** *Lab.* A chance seedling found in a Concord vineyard. It was sent to this Station in 1892 and bore its first few clusters of fruit this season. These bunches were medium to large, moderately compact; berry medium to large, usually uniformly above medium, black with blue bloom, juicy, vinous; pulp quite tender and separates readily from the very few seeds; very good in quality. When pulled from the cluster the berry leaves white fibres attached to the pedicel. Equal or superior to Concord and a few days earlier this year. Should it prove productive it will be worth further testing for a market grape. See, also, Annual Report of this Station for 1892, p. 618.

**Columbian.** Received from the Columbian Grape Company, Kingston, O., in the spring of 1894.

**Daisy.** (*Lab., vin.*). Unproductive here in 1893 and 1894. Only partly self-fertile and if planted at all should be mixed with other varieties in order to secure better fertilization of the blossoms. It is not worthy of introduction in this section. See, also, Annual Reports of this Station for 1891, p. 495, and 1892, p. 619.

**Duchess.** *Lab. X, (Lab., Bourq.).* As grown on our heavy clay soil it does not rank more than good to very good in quality. It is partly self-fertile but will probably do better in mixed vineyards than when grown alone. The pulp is tender, vinous and nearly sweet; the seeds are tender and easily crushed. Begins to ripen last of September or first of October. The fully ripened berries have a decided brown or reddish-brown tinge on the side exposed to the sun, and the little dark specks thinly scattered over the skin are quite characteristic. It is highly esteemed in some localities.

**Early Ohio.** *Lab.* or *Lab. X.* A chance seedling received from C. S. Curtis & Co., Portland, N. Y., 1891. Vines moderately vigorous with good foliage; bunch medium or below, not compact; berry medium, black with blue bloom; pulp not melting, sweet; seeds few and separate easily from the pulp; fair quality; productive. Season about with Moore's Early. See, also, Annual Report of this Station for 1893, p. 619.

**Elsinburgh.** (*Elsinboro, Smart's Elsinborough*), *æst.* An old variety received from T. S. Hubbard, Fredonia, N. Y., in 1888. Bunch medium to large, moderately compact, shouldered, spreading, with rather long branches; berry small, black with blue bloom, nearly round, sweet, vinous, with but little pulp and few small seeds; juice colored. Berry too small to meet with favor as a market grape. Season last of September and first of October. See, also, Annual Reports of this Station for 1891, p. 495, and 1892, p. 621.

**Elvicand.** *cand. X, (cand., vul., Lab.).* This variety was recommended for trial as a dark red grape of Concord season in the Annual Reports of this Station for 1892 and 1893. In 1894 it was very productive and confirmed the favorable opinion that had previously been formed of it.

**Empire State.** (*Lab. X Rip.*) The vine is not a vigorous grower here, but was quite productive this season. The clusters are long, rather slender and borne on long, slender stems, the distance between the vine and fruit being rather longer than usual and quite characteristic of this variety. The berries are medium in size, white tinged with yellow; pulp tender, sprightly and of good quality. Season first of October.

**Gold Dust.** *Lab. X, (Lab., vin., Bourq.).* Mildly, subacid; pulp tough; does not release the seeds readily; insipid; poor quality. See no reason for further testing in this locality. See, also, Annual Report of this Station for 1892, p. 624.

**Golden Grain.** *Lab. X, (Lab., vin., Bourq.).* Clusters medium or above, usually compact, shouldered; berries medium size, oblong, dull green, with thin white bloom and thinly sprinkled with brown dots; skin tough; pulp tough and does not separate readily from the seeds; moderately juicy, sweet, pleasant

flavor. Inclined to drop from the cluster when ripe. Not equal to Niagara in appearance and would no doubt prove inferior to it as a market grape. Not worthy of introduction in this locality. Ripens about with Concord.

**Hercules.** (*Lab., vin.*) When the long drought of the summer was broken by autumn rains the fruit began to crack and was much injured in this way. This fault was noticed in 1892, but was not apparent in 1893. On account of the liability of the fruit to crack and drop from the cluster, and because of the tough pulp, this variety is unworthy of introduction into commercial vineyards in this section of the country. See, also, Annual Reports of this Station, 1892, p. 625, and 1893, p. 620.

**Horsford.** *Horsford's Mammoth.* Received in the spring of 1894 from R. M. Kellogg, Ionia, Mich.

**Isabella Seedling.** *Lab.* This is a variety of considerable merit on account of its vigor, productiveness, earliness, fine formed clusters of good appearance, vinous flavor and the good quality of its fruit. It begins to ripen a little later than Moore's Early. In fact it might be called an early Isabella. The fruit keeps quite well in cold storage. The clusters are more compact than those of the Isabella, being moderately compact and slightly shouldered. The berries are medium to large, oblong, black with blue bloom, vinous flavor and good quality. Worthy further testing. The variety was received here in 1889 from G. A. Ensenberger, Sr., Bloomington, Ill. See, also, Annual Reports of this Station, 1892, p. 636, and 1893, p. 621.

**Juno.** (*Bourq., Lab.*) Unproductive this year. Of no use here as compared with other good varieties of the same season. See, also, Annual Report of this Station for 1892, p. 627.

**Kensington.** Received in the spring of 1894 from Prof. Craig, Ottawa, Canada.

**Linlmar.** *Lab. X, (Lab. vin.)* Another season's trial confirms the opinion previously formed of this variety. It is not worthy of introduction in this locality. See, also, Annual Reports of this Station for 1892, p. 623, and 1893, p. 621.

**Lutie.** (*Lab.*,—?) A chance seedling, received from Samuel Wilson, Mechanicsville, Pa., in 1892. It bore a few clusters of fruit this year. Bunch small to medium, moderately compact; berry medium to large, round, dull dark red with slight whitish bloom; pulp sweet with a strong foxy odor, moderately juicy, moderately tender, releases the seeds readily, fair in flavor and quality. Season earlier than Concord; about with Worden this year.

**Missouri Riesling.** (*vul.*, *Lab.*) A seedling of Taylor raised by Nicholas Grein, near Hermann, Mo. Bunch medium, rather loose. Berries greenish-white, tinged with pink when fully ripe, sprinkled with small brown dots and covered with white bloom, nearly round, but tapering toward the pedicel. Pulp does not readily release the seeds, is moderately juicy, mild in flavor, sweet, but not sprightly enough to rank high as a table grape in American markets. Berry thin-skinned, fine flavored, with no foxiness. Begins to ripen a little before Catawba. See, also, Annual Reports of this Station, 1891, p. 497, and 1892, p. 630.

**Norwood.** *Lab.* Cluster moderately compact; berry above medium, inclined to oval, purple with blue bloom; skin thick and tough; pulp moderately tough, not readily releasing the seeds, nearly sweet, fine flavor. Incapable of self-fertilization and unproductive here, even in a mixed vineyard. This fault is sufficient to debar it from the commercial list, and there are other grapes of its season that are superior to it for amateur purposes. Began to ripen this season the first week in October.

**Opal.** (*Lab.*, *vin.*) Cluster medium, compact; berry small to above medium, nearly round, green, covered with thin white bloom; pulp tough, not readily releasing the seed; sweet, sprightly vinous, good quality, with little or no foxy flavor. Season about with Niagara. It can not compete with that variety as a market grape, and for amateur purposes, it is inferior to other white grapes of its season. Can see no reason for its introduction in this locality. It is fully self-fertile. See, also, Annual Reports of this Station for 1892, p. 632, and 1893, p. 622.

**Pocklington.** *Lab.* A seedling of Concord. Unproductive this season. Not as satisfactory here as Niagara. It is sometimes so'd for Niagara, as it readily passes for that variety

in the market, and being somewhat earlier than the Niagara it brings better prices than when sold under its own name. Cluster medium to large; berry nearly round, green, or yellow when fully ripe, with occasional distinct brown dots; has a foxy odor and some foxy flavor, sweet, fair to good in quality.

**Rommel.** *Lab. X, (Lab., vin, vul.).* A seedling of Elvira X Triumph, originated by T. V. Munson, Denison, Texas, and sent to this Station in 1892. Begins to ripen about the same season as Concord. Cluster medium or above, moderately compact; berries medium to large, round or oblate, with thin skin, which cracks badly; green or pale green, covered with white bloom; pulp melting, juicy, nearly sweet, good quality. Vine vigorous and healthy. Can not be recommended for this locality on account of the cracking of the fruit, and on our soil it does not attain high flavor.

**Roscoe.** *Lab. X, (Lab., Bourq.).* A seedling of Delaware X Martha, originated by T. V. Munson, Denison, Texas; sent to the Station in 1888. It bore its first fruit here last year. Vine vigorous, with healthy foliage. The clusters resemble Delaware in size and shape; berries nearly round, white or pale green, with white bloom; nearly sweet, sprightly, good flavor and quality; pulp tough, not readily releasing the seeds. Not very productive this season. Begins to ripen about with Delaware. The blossoms are incapable of setting fruit unless cross fertilized. Do not consider it worthy of introduction, since there are other better white grapes of its season for this section.

**Shelby.** Received from D. S. Marvin, Watertown, N. Y., in the spring of 1894.

*Seedlings unnamed as follows:*

**Guest's No. 1.** Received from Fred. M. Guest, Fredonia, N. Y., 1894.

**Horner's No. 1.** Received from Joel Horner, Delair, N. J., 1894.

**Marvin's Seedling White.** Received from D. S. Marvin, Watertown, N. Y., 1894. Bore its first fruit this year. Clusters medium, compact; berry small to medium; inclined to drop from the stem; pale green or yellow, sometimes faintly tinged with

pink; thin white bloom; pulp moderately firm, readily releases the seeds, nearly sweet, somewhat vinous, good quality. Season, last of September. Do not think it worthy of introduction either as an amateur or market variety, since it shows no points of superiority over well-known kinds of its season.

*Thompson's No. 5.* Received from Joseph T. Thompson, Oneida, N. Y., 1894.

*Thompson's No. 7.* Received from Joseph T. Thompson, Oneida, N. Y., 1894.

## Variety Test of Pears.

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The trees in the Station pear orchards are young and just beginning to fruit. It is thought best to defer publishing notes on the varieties in these orchards till the trees are more mature. The following is a list of the varieties now growing here, exclusive of the Station seedlings. Unnamed seedlings and synonyms are printed in italics.

### LIST OF PEARS IN STATION ORCHARDS IN 1894.

Anna Nellis.  
Angou'eme.  
Anjou.  
Ansault.  
Arkansas Mammoth.  
Assomption.  
Autumn Bergamot, *No. 122.*  
*Ayer No. 1.*  
Bartlett.  
Bartseckel.  
Bessemianka.  
Bezi de la Motte.  
Bordeaux.  
Bosc.  
Boussock.  
Brandywine.  
Brignais.  
B. S. Fox.  
Buffum.  
Centennial.  
Chinese Sand.  
Cincincois.  
Clairgeau.  
Clapp's Beauty.  
Clapp's Favorite.  
Cocklin.  
Coles.  
Columbia.  
Congress.  
Comet.  
Comice.

Craig.  
Crow's Choice.  
Daimyo.  
Dana's Hovey.  
Dearborn's Seedling.  
Delices de Louvenjal.  
Dewey's Premium.  
Directeur Alphande.  
Dix.  
Doctor Farley.  
Doctor Reder.  
Dula.  
Early Bergamot.  
Early Harvest.  
Easter Beurre.  
Ellis.  
*E. No. 47.*  
Esperen.  
Exeitier.  
Fitzwater.  
Flat Bergamot.  
Flemish Beauty.  
Fondante d'Automne.  
Fondante de Bihorel.  
Fortunee Boisselot.  
Frederic Clapp.  
Gakovsky.  
Gans. =  
Gansel's Seckel.  
Garber.  
Gifford.

Goodale.  
 Hosenschenck.  
 Howell.  
 Idaho.  
 Japan Golden Russet.  
 Jaques Molet.  
 Jones  
 Josephine de Malines.  
 Kieffer.  
 Kingsessing.  
 Kinsman.  
 Kurskaya.  
 Lamartine.  
 Late Bartlett.  
 Lawrence.  
 Lawson.  
 Le Conte.  
 Limbertwig.  
 Lincoln.  
 Lincoln Coreless.  
 Little Gem.  
*Longworth No. 1.*  
 Lucy Duke.  
 Madam Appert.  
 Madam Millet.  
 Madam Treyve.  
 Madam von Siebold.  
 Manning's Elizabeth.  
 Marie Benoist.  
 Marshall.  
 Maurice Desportes.  
 Miriam.  
 Mt. Vernon.  
 Nickerson.  
 No. 6.

No. 439.  
 Old Crassane.  
 Ontario.  
 Osband's Summer.  
 Passans du Portugal.  
 P. Barry.  
 Peffer.  
*Peffer No. 3.*  
 Pitmaston Duchess.  
 Pound.  
 Pres. Drouard.  
 Ravenwood.  
 Raymond de Montlaur.  
 Refreshing.  
 Reliance.  
 Ritson.  
 Rutter.  
 Seckel.  
 Sheldon.  
 Shull.  
 St. Crispin.  
 Superfin.  
 Theresa Appert.  
 Tyron.  
 Urbaniste.  
 Van Cott.  
 Vermont Beauty.  
 Victor.  
 White Doyenne.  
 Winter Bartlett.  
 Winter Nellis.  
 Youngken's Favorite.  
 Zuckerbirn.

Total, 130.

## Variety Tests of Raspberries.

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Many of the older varieties of raspberries have been thoroughly tested at this Station and reported on in previous years. Therefore it has been thought best to discard a large number of them and retain only a few of the standard varieties for comparison with the newer sorts. Information concerning any of these older varieties that have been tested will be cheerfully furnished upon application.

### BLACK RASPBERRIES—NOTES ON VARIETIES.

**Eureka.** (*From W. N. Scarff, New Carlisle, O.*) Has not fruited yet.

**Haynes' Seedling.** (*From I. H. Haynes, Delphi, Ind., 1893.*) Fruit of medium size, firm, and somewhat seedy; moderately juicy, mild subacid, good flavor and quality. Berries are dull black and unattractive.

**Kansas.** (*From A. H. Griesa, Lawrence, Kan., 1893.*) Fruit medium to large, of good black color, moderately juicy, firm, slightly subacid, good flavor, fairly productive.

**Manwaring's Seedling.** (*From C. H. Manwaring, Lawrence, Kan., 1893.*) This variety has not yet been fruited at this Station.

**Mohler.** (*From D. M. Mohler & Co., New Paris, O., 1893.*) The plants of this variety resemble the Kansas in general appearance, but are larger and more vigorous. It promises to be very productive but the fruit is not as attractive in appearance as the Kansas. Berries medium to large, of dull black color, firm, juicy, nearly sweet, fair quality.

Most of the black raspberries have been recently transplanted, so their yields are not given. A list of the varieties now growing on the Station plats is given below :

American Everbearing.	<i>Manwaring's Seedling.</i>
Arctic.	<i>Mills' No. 7</i> (see Onondaga).
<i>Brackett's No. 101</i> (see Lotta).	<i>Mills' No. 15</i> (see Mills).
Carman.	Mills.
Eureka.	Mohler.
<i>Haynes' Seedling.</i>	Ohio.
Hilborn.	Older.
Kansas.	Onondaga ( <i>Mills' No. 7</i> ).
Lotta ( <i>Brackett's No. 101</i> ).	<i>Smith's No. 2.</i>

Spry's Early.

Hilborn produced a good crop of fruit this year. In 1893 it was reported as being worthy of extended trial on account of its productiveness, vigor and excellent fruit. American Everbearing was moderately productive this season. It produced a few fruits in September, but not enough to be of any value. Lotta is only moderately productive of medium-sized fruit. Arctic was fruited here for the first time last season; it has been only moderately productive thus far of medium-sized fruit. Mills (*Mills' No. 15*) and Onondaga (*Mills' No. 7*), both of which received favorable notice in the report of this Station for 1893, were transplanted that fall; therefore no report can be made on them this year.

### RED RASPBERRIES.

The following table shows the yield of red raspberries fruited at this Station in 1894, the per cent. of the crop picked before July 13 and the per cent. picked after July 25. The plants are set in rows 25 feet in length and are allowed to form matted rows at once. Those varieties that produced their first crop this year are not comparable with those that have borne fruit for one or more seasons, because they have not yet come into full bearing.

TABLE III—SHOWING RELATIVE PRODUCTIVENESS AND EARLY AND LATE YIELD OF RED RASPBERRIES IN 1894.

Rank as to yield, 1894.	NAME.	When set.	Per cent of crop picked prior to July 18.	Per cent. of crop picked after July 20.	Yield of matted row $\frac{1}{2}$ foot in length.
					Ounces.
12	Brandywine .....	1892	.....	32	34
5	Clarke .....	1892	5	23	151
*	Cline .....	1893	.....	.....	.....
*	Crimson Beauty .....	1893	.....	.....	.....
6	Cuthbert .....	1892	3	21	149
2	Cuthbert ( <i>Quinby's Favorite</i> ) ....	1892	3	22	193
*	Early Pride .....	1893	27	17	60
7	Early Prolific .....	1892	18	24	119
1	Harris .....	1889	11	22	† 290
10	Miller's Woodland .....	1892	13	26	76
*	Naomi .....	1893	.....	.....	.....
*	Olathe ( <i>Stayman's No. 5</i> ) .....	1893	.....	34	129
8	Pomona .....	1892	26	12	† 87
4	Pride of Kent .....	1892	36	11	† 165
*	Pumphrey's No Name .....	1893	.....	.....	.....
*	Reder .....	1893	10	23	71
*	Reliance .....	1893	24	10	21
11	Royal Church .....	1892	.....	36	§ 58
	<i>Stayman's No. 5</i> , see Olathe .....	.....	.....	.....	.....
3	Superb .....	1892	13	24	174
9	Turner .....	1892	33	7	83

## EARLY RED RASPBERRIES.

The greater part of the red raspberries ripened between the dates of July 13 and 25. Those varieties that ripened a considerable portion of their crop prior to July 13 may be called early, and those that ripened a considerable portion of their crop after July 25 may be called late for this season.

Table III shows that eight varieties yielded over 12 per cent. of their crop before July 13.

Table IV gives the dates of the first picking, together with the yield of these eight varieties.

\* First crop.

† Yield computed from 80 per cent. of a full row.

‡ Yield computed from 66 $\frac{2}{3}$  per cent. of a full row.

§ Yield computed from 43 per cent. of a full row.

TABLE IV—EARLY RED RASPBERRIES RANKED ACCORDING TO YIELD PRIOR TO JULY 13, 1894.

NAME.	Date of first picking.	Ounces yielded before July 13.	Total ounces yielded.	Rank as to total yield.
Early Pride .....	July 3	16	60	*
Early Prolific .....	June 30	22	119	7
Miller's Woodland .....	July 5	11	76	10
Pomona .....	July 3	15	58	8
Pride of Kent.....	June 30	47	131	†4
Reliance.....	July 3	5	21	*
Superb .....	July 5	22	174	3
Turner .....	July 3	27	83	9

Superb was noted last year as being very unproductive. Early Prolific is moderately productive of fruit of good quality, and is remarkable for its long fruiting period, being classed with both early and late varieties. Pomona made a good showing this season, as it has done in previous years. It seems to be worthy of introduction in this locality. Turner is an old variety and very hardy. Its fruit is inferior to Cuthbert in size and firmness.

\* First crop.

† Yield computed from 80 per cent. of a full row.

## LATE RED RASPBERRIES.

Classing those varieties as late that yielded one-fourth or more of their crop after July 25, Table III shows a list of 11 varieties, which are given in the following :

TABLE V — LATE RED RASPBERRIES RANKED ACCORDING TO YIELD AFTER JULY 25, 1894.

NAME.	Date of last picking.	Ounces yielded after July 25.	Total ounces yielded.	Ranked as to total yield 1894.
Brandywine.....	August 4	11	34	12
Clarke .....	August 8	35	151	5
Cuthbert .....	August 8	31	149	6
Cuthbert ( <i>Quinby's Favorite</i> ).....	August 8	44	193	2
Early Prolific .....	August 8	28	119	7
Harris*.....	August 8	53	232	1
Miller's Woodland .....	August 4	20	76	10
Olathe ( <i>Stayman's No. 5</i> )†.....	August 8	44	129	.....
Reder† .....	August 8	16	71	.....
Royal Church‡ .....	August 8	9	25	11
Superb .....	August 8	43	174	3

Harris yielded much the largest crop of any of the red raspberries fruited here in 1894, but the plants were set in 1889, so have become well established, which fact should be taken into consideration when comparing its yield with other varieties which have not been set so long. It produces excellent fruit which resembles Cuthbert in size and quality. Cuthbert and Quinby's Favorite appear to be identical, unless, as was suggested in 1893, Quinby's is an improved strain of Cuthbert. Rows of both of these berries were fruited this year under exactly similar conditions, which resulted in Quinby's taking second rank as to yield while Cuthbert ranked sixth. Clarke in 1893 was noted as "a well-known old variety and one of the most productive tested at this Station." It ranks fifth in productiveness for 1894. Royal Church has given very good results in previous years, but this year, on account of being recently transplanted, it has fallen much below its average.

\* Yield computed from 80 per cent. of a full row.  
 † First crop.

‡ Yield computed from 43 per cent. of a full row.

## PURPLE RASPBERRIES.

Most of the purple raspberries have been recently transplanted so that only the one variety, Addison, bore fruit this season. The following list gives the names of the varieties that are now growing on the Station plats.

Addison.	Columbian.
<i>Babcock No. 1.</i>	Shaffer.
Cardinal.	<i>Smith's Purple.</i>

Addison is only moderately productive, the yield of five hills now in a matted row was 106 ounces. The fruit is of good quality, having the flavor of the wild red raspberry, while the plants have the habit of growth of the black raspberries. Columbian was transplanted after fruiting in 1893, so no farther report can be given on it at this time as we have no plants in bearing.

## YELLOW RASPBERRIES.

A list of the yellow raspberries now growing on the Station plats is given below.

Caroline.	Golden Thornless.
Champlain.	Orange.
Crystal ( <i>Crystal White</i> ).	Vermont.
Golden Queen.	

Of the three varieties that produced fruit this year Caroline is first in productiveness as it was last year, ranking about with Cuthbert (Quinby's). Golden Thornless is an old variety which produces fruit of good quality. Vermont was one of the most productive of the yellow raspberries in 1893; it was only moderately productive this year. None of the yellow berries are suitable for a market crop, but many of them are very desirable for the home garden.

## LIST OF RASPBERRIES SET IN THE SPRING OF 1894.

*Babcock's Seedling*, from D. W. Babcock, Dansville, N. Y.

*Babcock No. 3*, from D. W. Babcock, Dansville, N. Y.

*Babcock No. 5*, from D. W. Babcock, Dansville, N. Y.

*Babcock No. 9*, from D. W. Babcock, Dansville, N. Y.

*Beckwith's Seedling*, from Prof. M. H. Beckwith, Newark, Del.

Columbian, from Joseph T. Thompson, Oneida, N. Y.  
 Cromwell, from W. D. Barns, Middle Hope, N. Y.  
 English Giant, from W. D. Barns, Middle Hope, N. Y.  
 Eureka, from A. M. Purdy, Palmyra, N. Y.  
 Golden Prague, from W. D. Barns, Middle Hope, N. Y.  
 Hopkins, from A. M. Purdy, Palmyra, N. Y.  
 I. X. L., from Charles Schlessler, Naperville, Ill.  
 Kenyon, from O. A. Kenyon, McGregor, Ia.  
 King, from Cleveland Nursery Co., Rio Vista, Va.  
 Loudon, from F. W. Loudon, Janesville, Wis.  
 Palmer, from Charles Mills, Fairmount, N. Y.  
 Pioneer, from D. B. Garvin & Son, Wheeling, W. Va.  
*Poscharsky No. 3*, from F. W. Poscharsky & Son, Princeton, Ill.  
*Poscharsky No. 9*, from F. W. Poscharsky & Son, Princeton, Ill.  
*Poscharsky No. 15*, from F. W. Poscharsky & Son, Princeton, Ill.  
 Redfield, from J. Wragg & Son, Waukee, Ia.  
 Red Sweet, from W. D. Barns & Son, Middle Hope, N. Y.  
 Superlative, from Ellwanger & Barry, Rochester, N. Y.  
 Talbot Prolific, from M. I. Ellis, Norwood, Mass.  
*Townsend's No. 2*, from George Townsend, Gordon, O.

## Variety Tests of Strawberries.

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### NOTES ON STRAWBERRIES FOR 1894.

In the following report on the varieties of strawberries grown at this Station a description of varieties fruited here for the first time in 1894 is given, together with a few brief additional notes on varieties reported on in previous years. This is followed by a comparison of the different kinds as regards their productiveness and season of ripening. This report is based wholly on records of the plants as grown at this Station.

It seems hardly necessary to state that this report is offered simply as a contribution to our knowledge of the value of the different varieties considered therein, and of their relative merits when compared with each other. It is conceded that no kind of strawberry, or other fruit, succeeds equally well in all localities, and the fact that a variety takes first rank in one section of country does not necessarily demonstrate its ability to do the same thing in every locality and with every combination of soil and climatic conditions. Nevertheless, the comparisons of varieties made at this Station in previous years have given results remarkably in accord with the general records made by these varieties throughout the State, thus demonstrating the value of the Station's reports on small fruits to those who are interested in small fruit culture. The success of a particular variety here does not prove its ability to succeed elsewhere, yet it may be taken as an indication of its value and that it is worthy a place on the trial list in other localities. The popular demand for such information as is contained in this Station's annual reports on small fruits is sufficiently indicated by the rapidity with which the editions of the small fruits bulletins are exhausted.

The strawberries grown here are on rather stiff clay loam, well tile-drained and made fertile with stable manure. They were formerly tested both in hills and in matted rows, but now are grown only in matted rows. During the first season they

are given clean cultivation. After the ground freezes in early winter they are covered four or five inches deep with straw or coarse manure. They are given one cultivation in the spring as soon as the ground is fit to be worked, usually with a Planet Jr. cultivator. The mulch is then removed from the beds and placed between the rows, where it is left until the crop is picked. One or two inches of the mulch is left on the plants to keep the ground moist and the fruit clean. Plate I illustrates this manner of mulching the strawberries.

Before the fruit ripens an area of 33 square feet is laid out in each bed. The fruit borne on this area is carefully weighed and a complete record kept of the date and weight of each picking.

As a rule it is probably best to set plants in the spring, and after taking one crop of fruit plow the bed under. With plants that make runners very slowly it sometimes happens that the second year's yield is better than the first. For this and other reasons, which it is not necessary to state in this connection, strawberry beds at this Station are commonly fruited two years.

### NOTES ON VARIETIES.

In the following notes the blooming season of pistillate plants is in each case compared with the blooming season of some well-known staminate variety as a guide in choosing staminate plants for fertilizing the blossoms of the pistillate plants.

The quality of the fruit is indicated by the terms "poor," "fair," "good," "very good" and "best." Stems of average length and strength are called "good stems"; short, long or prostrate stems are specially mentioned when necessary.

Synonyms and unnamed seedlings are given in italics.

Staminate varieties, those having perfect flowers, are marked "S" while pistillate varieties, those having imperfect flowers, are marked "P."

\***Accomack**, S. (*From A. J. McMath, Olney, Va., and Slaymaker & Son, Dover, Del.*) Unproductive. Good scarlet color.

\***Advancer**, S. (*From R. S. Cole, Harmons, Md.*) Unproductive. Dark scarlet color.

\***Allen's No. 1**, P. (*From W. F. Allen, Jr., Salisbury, Md.*) Blossoms with Capt. Jack. Unproductive. Dark scarlet color.

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\* Varieties marked with a \* were fruited in beds two years old. More complete descriptions of them may be found in Bulletin 64 of this Station or the Annual Report for 1893.

\**Allen's No. 3, S.* (From *W. F. Allen, Jr., Salisbury, Md.*) Unproductive.

*Allen's No. 5, P.* (From *W. F. Allen, Jr., Salisbury, Md.*) Blossoms with Sharpless. Foliage very good; runners abundant. Fruit medium to large, dark crimson, borne on good stems, fair quality, moderately firm, productive. Of more than forty varieties fruited for the first time this season, *Allen's No. 5* was most productive.

*Allen's No. 6, P.* (From *W. F. Allen, Jr., Salisbury, Md.*) Blossoms with Sharpless. Fruit medium or above in size, good quality, moderately firm, dark scarlet color, borne on good stems. Foliage good; runners abundant. Among the varieties fruited here for the first time in 1894 it ranks tenth in productiveness.

*Allen's No. 13, P.* (From *W. F. Allen, Jr., Salisbury, Md.*) Begins to blossom a few days earlier than Sharpless. Foliage rather small and moderately abundant; runners abundant. Fruit medium size, borne on good stems, dark scarlet color, moderately firm, fair quality. Among the varieties fruited here for the first time in 1894 it ranks fifth in productiveness.

*Allen's No. 14, P.* (From *W. F. Allen, Jr., Salisbury, Md.*) Begins to blossom a few days earlier than Sharpless. Foliage very good; runners very abundant. Fruit medium size, good light scarlet color, firm, good quality. The fruit has a neck which is considered an objectionable feature by some growers. Among the varieties fruited here for the first time this season it ranks fourteenth yet on account of its vigor, and the firmness, good color and good quality of its fruit, it should be tested further before being discarded.

\**Arkansaw Traveler, P.* (From *T. G. Michel, Judsonia, Arkansas.*) Fruit scarlet color. Unproductive here.

\**Aroma, S.* (From *E. W. Cruse, Leavenworth, Kans.*) Fruit medium to large, borne on good stems, scarlet, firm, poor quality. Foliage first class. Runners very abundant. Not productive this season.

*Beauty, P.* (From *J. H. Haines, Delphi, Ind.*) A beautiful berry of bright scarlet color. It yields a considerable portion of its crop early in the season. Though it does not take first rank

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\*Varieties marked with a \* were fruited in beds two years old. More complete descriptions of them may be found in Bulletin 64 of this Station or the Annual Report for 1893.

as to yield this season, still it is productive, and on account of its attractive appearance and earliness it is considered worthy of further testing for local market. Fruit medium to large, borne on good stems, fair quality, soft. Foliage excellent; runners abundant.

**\*Belle, S.** (*From Cleveland Nursery Co., Rio Vista, Va.*) Fruit scarlet color. Unproductive.

**\*Beverly, S.** (*From B. W. Smith, Beverly, Mass.*) Only moderately productive. Fruit dark scarlet, medium size, good and firm.

**Brandywine, S.** (*From E. T. Ingram, Westchester, Pa.*) Foliage very good; fruit stems good; runners very abundant. Fruit medium to large, dark scarlet color, with yellow seeds, fair quality, soft. Among the varieties fruited here for the first time in 1894, it ranked twenty-second, being only moderately productive. Midseason to late.

**Bryant, S.** (*From Jackson & Perkins, Newark, N. Y.*) Received here under the name Eureka, but as it is not the true Eureka it has since been named "Bryant" in honor of the originator. Foliage moderately vigorous; runners abundant; fruit stems good. Fruit scarlet, medium size or above, fair quality, firm. The record of its yield for this season is incomplete.

**\*Bubach, P.** This variety is now generally well and favorably known. It begins to blossom a few days later than Capt. Jack. Fruit dark scarlet, roundish wedge-shaped, fair to good in quality, moderately firm. This season among the varieties fruiting in beds two years old it was the most productive. The fruit is moderately firm and may be shipped to near markets. It also holds its color well when canned.

**\*Cameronian, S.** (*From L. J. Farmer, Pulaski, N. Y.*) Fruit dark scarlet color. Only moderately productive.

**\*Chair's Favorite, S.** Fruit light scarlet color. Not very productive.

**\*Cheyenne, P.** (*From Stayman & Black, Leavenworth, Kan.*) Fruit of good scarlet color but not very productive.

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\* Varieties marked with a \* were fruited in beds two years old. More complete descriptions of them may be found in Bulletin 61 of this Station, or the Annual Report for 1893.

**\*Clark's Early**, *Early Idaho*, S. (From *Slaymaker & Son, Dover, Del., and D. Brandt, Bremen, Ohio.*) Fruit medium size, dark scarlet color. Has proved no more than moderately productive.

**\*Clyde**, *Cycloma*, S. (From *Stayman & Black, Leavenworth, Kan.*) Fruit of good scarlet color. Plants unproductive.

**Columbia**, S. (From *West Jersey Nursery Co., Bridgeton, N. J.*) Fruit medium or above, pale crimson color, flavor resembles Lennig White somewhat, soft, poor quality. Fruit stems and foliage good. Runners abundant. Productiveness can not be definitely stated but does not rank high.

**\*Crosby's 91**, S. (From *Phineas Crosby, Clinton, Wis.*) Fruit crimson color, moderately productive.

**Cruse No. 9**, S. (From *E. W. Cruse, Leavenworth, Kan.*) Fruit medium to large, medium size, scarlet, fair quality, moderately firm. Foliage good; runners moderately abundant. Plants moderately productive.

*Cycloma*, see **Clyde**.

**Cyclone**, S. (From *E. W. Cruse, Leavenworth, Kan.*) Foliage vigorous; fruit stems good; runners abundant. Fruit medium size, fair to good, moderately firm, scarlet. Moderately productive.

**\*D. and D.**, S. (From *Prof. E. S. Goff, Madison, Wis.*) Moderately productive. Fruit dark scarlet.

**\*Dayton**, *Dayton Early*. (From *Sam'l Kinsey & Co., Kinsey, O.*) Only moderately productive here.

**\*Dew**, S. (From *D. Brandt, Bremen, O.*) Fruit dark scarlet, moderately firm, moderately productive.

*Dow's Seedling*, see **Epping**.

*Early Idaho*, see **Clark's Early**.

**\*Edward's Favorite**, S. (From *R. S. Edwards, Highlands, Colo.*) Fruit of good scarlet color with glossy surface. Plants moderately productive on our soil.

**\*Engle's No. 1**, S. (From *T. T. Lyon, South Haven, Mich.*) Fruit scarlet color. Plants not very productive.

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\* Varieties marked with a \* were fruited in beds two years old. More complete descriptions of them may be found in Bulletin 64 of this Station or the Annual Report for 1898.

\***Epping**, *Dow's Seedling*, *Yankee Doodle*, P. Moderately productive here. Fruit crimson.

\***E. P. Roe**, S. (*From T. J. Dwyer, Cornwall, N. Y.*) Very unproductive. Fruit scarlet, round or roundish conical, borne on rather short stems, medium size, very good quality, firm.

*Eureka*. Bryant was first received here under this name.

\***Eureka**, P. (*From J. Little, Granton, Ontario.*) Blossoms with Sharpless. Moderately productive. It bears handsome fruit of good quality, but we do not consider it equal, on the whole, to other standard varieties.

\***Everbearing**, S. (*From Chas. S. Lindley, Emporia, Va.*) Fruit scarlet, moderately firm. Plants not very vigorous and not very productive this season.

\***Galerson**, S. (*From Ellwanger & Barry, Rochester, N. Y.*) Fruit dark scarlet color. Plants unproductive here this season.

\***Gandy**, S. A fine, large, late berry; moderately productive. It takes first rank as a late berry among the varieties tested at this Station.

\***Gandy Belle**, S. (*From S. B. Cole, Bridgeton N. J.*) Fruit dark scarlet color. Not so productive as Gandy this year.

\***Gen. Putnam**, P. (*From G. H. & J. H. Hale, South Glastonbury, Conn.*) Blossoms about with Capt. Jack. Not very productive here.

\***Glenfield**, S. (*From Stayman & Black, Leavenworth, Kan.*) Fruit stems good; foliage good; runners not abundant. Fruit dark scarlet or crimson, good quality. Plants not very productive.

\***Greenville**, *Buechley's Seedling*, P. (*From E. M. Buechley, Greenville, O.*) Blossoms about with Capt. Jack. This was received here in 1890, and is mentioned in the Station's annual report for that year, p. 267, as Buechley's Seedling. In the report for 1891, p. 461, it is described as "having the general appearance of Sharpless; fruits varying in shape, some of Bubach type, some of Sharpless type, without the green

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\* Varieties marked with a \* were fruited in beds two years old. More complete descriptions of them may be found in Bulletin 64 of this Station or the Annual Report for 1898.

tip, and others conical in shape, being found on the same plant; fruits firm enough to ship, not of finest flavor, but better than the average." The 1892 report says (p. 681): "Greenville follows Beder Wood in productiveness and has the advantage of being larger. It would probably sell for more per quart than the former." Among the berries fruited here in 1892 Greenville stood second in yield.

In 1893 and 1894 it has not taken as high a rank as it did in 1892, but this may be due in part to the conditions under which it was grown. It is an excellent berry, but we are not yet convinced that it is better than some of the standard varieties for our soil.

*\*Hall's Seedling, P. (From S. E. Hall, Cherry Valley, Ill.)* Good scarlet color, moderately productive this season.

*Haynes' 31, P. (From J. H. Haynes, Delphi, Ind.)* Begins to blossom a few days before Sharpless. Fruit medium to large, borne on medium stems, deep scarlet color, moderately firm, fair quality. In productiveness it stands second among the varieties fruited here for the first time this season.

*\*Herbert, S. (From B. L. Carr, Saratoga Springs, N. Y.)* unproductive here.

*\*Holcomb's Seedling, S. (From W. C. Holcomb, Mecca, O.)* Crimson color. Not very productive this year.

*\*Kincks, S. (From Clark Hewett, Waupun, Wis.)* Fruit good scarlet color. Plants productive.

*\*Latest of all. (From Ellwanger & Barry, Rochester, N. Y.)* Plants weak and unproductive.

*\*Laxton's Captain, S. (From Ellwanger & Barry, Rochester, N. Y.)* Plants weak and unproductive.

*Leader, S. (From Wm. Parry, Parry, N. J.)* Plants vigorous; runners abundant; fruit stems good. Fruit medium size or below, dark scarlet color, fair quality, soft. Plants moderately productive.

*Luther, S. (From A. Luther Leeds, Jackson county, Mo.)* Foliage vigorous; fruit stems good; runners very abundant; plants moderately productive. Fruit medium size or above, scarlet color, fair to good quality, moderately firm.

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\* Varieties marked with a \* were fruited in bds two years old. More complete descriptions of them may be found in Bulletin 64 of this Station or the Annual Report for 1893.

**\*Magnate**, P. Blossoms with Beder Wood. Fruit dark scarlet, moderately firm. Plants not very productive.

*Manchester No. 1*, P. (From Jackson & Perkins, Newark, N. Y.) Blossoms with Sharpless or later. Foliage vigorous, but rather small; fruit stems good; runners abundant. Plants moderately productive. Fruit medium to large, scarlet color, soft and not very good quality.

**\*Meek's Early**, *Advance*, S. (From Slaymaker & Son, Dover, Del.) Not productive here.

**\*Michel**, *Michel's Early*, S. For an early crop this variety takes the lead of all varieties tested, but the total yield for the season is not high. For local markets where very high prices are obtainable for early fruit it might be profitable to plant a few Michel; otherwise it is not productive enough to pay for growing commercially. Its fruiting season lasts about two weeks, but the greater part of its yield is given within eight or ten days from the time it begins to ripen.

**\*Muskingum**, S. (From S. R. Moore, Zanesville, O.) Fruit crimson color. Plants unproductive.

**Random**, S. (From G. W. Cline, Winona, Ontario.) Foliage first class; runners very abundant; fruit stems good. Plants not very productive. Fruit medium size, light scarlet, moderately firm, good quality.

*Reihl's No. 5*, P. (From E. A. Riehl, Alton, Ill.) Begins to blossom a day or two before Sharpless. Foliage and fruit stems good; runners abundant. One of the most productive of the varieties fruited for the first time this season. Fruit medium to large, moderately firm, fair quality, scarlet color.

*Riehl's No. 6*, S. (From E. A. Riehl, Alton, Ill.) Foliage and fruit stems good; runners abundant; plants moderately productive. Fruit dark scarlet, medium size or above, moderately firm, good quality.

**\*Rio**, *Thompson's No. 9*. (From Cleveland Nursery Co., Rio Vista, Va.) This season confirms the record of unproductiveness made by this variety last year. Mid-season, scarlet, good quality. Foliage good. Fruit stems short.

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\* Varieties marked with a \* were fruited in beds two years old. More complete descriptions of them may be found in Bulletin 64 of this Station or the Annual Report for 1893.

**Rush, P.** (*From Jackson & Perkins, Newark, N. Y.*) Blossoms two or three days later than Beder Wood. Foliage and fruit stems good; runners abundant; plants only moderately productive here. Fruit dark scarlet, medium size, moderately firm, fair quality.

**\*Sandoval, S.** (*From R. D. McGeehon, Atlantic, Iowa.*) Unproductive here this season the same as last.

**Saunders' Success, S.** (*From A. Saunders, Sac City, Iowa.*) Foliage very good; fruit stems good; runners abundant; plants unproductive. Fruit scarlet, medium size, fair quality, soft.

*See No. 1, S.* (*From H. S. & A. J. See, Geneva, Pa.*) Foliage small but vigorous; runners very abundant; fruit stems short; plants productive. Fruit medium or below, good crimson color, moderately firm, somewhat acid, good to very good in quality. Think the size is against it for a market berry.

*See No. 2, P.* (*From A. S. & A. J. See, Geneva, Pa.*) Begins to blossom two or three days later than Beder Wood. Foliage first class; runners very abundant; fruit stems good. Among the varieties fruited here for the first time in 1894, this ranks third in productiveness. Fruit medium or above, fair quality, soft, dark scarlet color.

**Sherman, S.** (*From J. H. Haynes, Delphi, Ind.*) Foliage and fruit stems good; runners abundant; plants moderately productive. Fruit very handsome, with glossy surface and bright scarlet color, medium to large, moderately firm, fair quality. Although not so productive as some other staminate varieties tested with it, still it is considered worthy of further testing on account of its handsome appearance.

**Shuckless, S.** (*From Hoover & Gaines, Dayton, Ohio.*) Foliage very good, runners very abundant, fruit stems good; plants but moderately productive. Fruit scarlet, medium or above in size, fair quality, soft. It receives its name from the characteristic way in which the fruit separates from the core and hull when it is picked. When this occurs, as it frequently does, the fruit is left not only "shuckless" but with a small cavity in the center unprotected from germs of decay by the natural covering of the fruit.

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\* Varieties marked with a \* were fruited in beds two years old. More complete descriptions of them may be found in Bulletin 64 of this Station or the Annual Report for 1893.

**\*Smith, P.** (*From Coe & Converse, Fort Atkinson, Wis.*) Blossoms about with Capt. Jack. Fruit scarlet. Plants productive this season.

**Splendid, S.** (*From C. H. Sumner, Sterling, Ill.*) Foliage good; fruit stems good; runners very abundant; plants moderately productive. Fruit scarlet, medium to large, good quality, moderately firm or soft.

**Sunny Side.** (*From Charles S Pratt, Reading, Mass.*) This was the most productive variety on the list at this Station in 1893. It was found necessary to use the ground where it stood for another purpose and, therefore, it was not fruited here this year.

**\*Swindle, P.** (*From G. H. & J. H. Hale, South Glastonbury, Conn.*) Unproductive here.

*Thompson's No. 9, see Rio.*

*Thompson's No. 40, P.* (*From Cleveland Nursery Co., Rio Vista, Va.*) This was erroneously recorded as No. 60 in bulletin 64. Fruit quite uniform in size, scarlet color. Bed was fruited the second season and proved less satisfactory than last year being only moderately productive, even when compared with other varieties fruited in beds two years old.

**Timbrell, P.** (*From E. W. Reid, Bridgeport, Ohio*) Begins to blossom a few days later than Sharpless. Foliage and fruit stems good; runners moderately abundant; plants only moderately productive. Fruit rounded, sometimes irregular, medium to large, crimson, mild flavor, fair to good quality, soft.

**\*Townsend's No. 2, S.** Fruit dark scarlet, shading to crimson. Not productive this season.

**\*Townsend's No. 3, P.** Fruit scarlet color. Not productive here this season.

**\*Townsend's No. 9, P.** Fruit scarlet color. Plants productive. This variety is considered worthy further testing.

**\*Townsend's No. 20, P.** (*From Geo. Townsend, Gordon, Ohio.*) Fruit dark scarlet, shading to crimson. Plants are only moderately productive.

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\*Varieties marked with a \* were fruited in beds two years old. More complete descriptions of them may be found in Bulletin 64 of this Station or the Annual Report for 1893.

\***West Lawn, P.** (*From C. B. Bauer, Judsonia, Ark.*) Fruit dark scarlet color. Plants only moderately productive.

**Wilson, Jr., S.** (*From F. L. Ray, East Claridon, O.*) Foliage very vigorous; fruit stems good; runners abundant; plants productive. Fruit medium size, crimson color, dark flesh, rather acid, moderately firm, fair quality.

*Yankee Doodle*, see **Epping**.

### NEW VARIETIES.

The following new varieties received for testing have not yet fruited here :

<i>Aldridge No. 25,</i>	Jay Gould,
Annie Laurie,	Marshall,
Blonde,	Marston,
Bostonian,	Mexican Everbearing,
Brunette,	Nan,
Champion of England,	Ona,
Charlie,	Orange County,
Dewdrop,	Tennessee, <i>Tennessee Prolific,</i>
<i>Eichholtz Seedling,</i>	White Novelty,
Equinox,	<i>Wilder No. 5,</i>
Giant,	<i>Wilder No. 7,</i>
<i>Hadsell's Seedling,</i>	<i>Young's Seedling.</i>
Iowa Beauty,	

### PRODUCTIVENESS AND SEASON OF RIPENING.

The varieties which fruited in beds two years old are not strictly comparable, so far as the yield is concerned, with the varieties fruited for the first time. Therefore it is thought best to separate the list into two groups, the first containing those varieties in beds one year old, the second containing those varieties fruited in beds two years old.

Excluding some Alpine varieties and all but one of the Station seedlings, the following is a list of strawberries fruited in beds one year old. The table also contains a statement of the yield of each variety in ounces from a plat containing 33 square feet; also the per cent. of the crop picked early, that is before June 21, and the per cent. of the crop picked late, that is after July 3.

\* Varieties marked with a \* were fruited in beds two years old. More complete descriptions of them may be found in Bulletins 64 of this Station or the Annual Report for 1893.

TABLE VI—LIST OF STRAWBERRIES FRUITED AT THIS STATION FOR THE FIRST TIME IN 1894, WITH A COMPARATIVE STATEMENT OF THE PER CENT. OF EARLY YIELD AND OF LATE YIELD FOR EACH VARIETY.

Rank as to yield, 1894.	NAME OF VARIETY.	Yield of 23 square feet in ounces, 1894.	Per cent. of crop picked prior to June 21.	Per cent. of crop picked after July 1.
1	<i>Allen's No. 5</i> .....P	312	1	4
2	<i>Haynes' No. 31</i> .....P	283	2	3
3	<i>See No. 2</i> .....P	196	2	10
4	<i>Riehl's No. 5</i> .....P	187	0	15
5	<i>Allen's No. 13</i> .....P	147	3	1
6	<i>Station No. 198</i> .....P	144	0	73
7	<i>Beauty</i> .....P	142	0	31
8	<i>See No. 1</i> .....S	139	29	2
9	<i>Wilson, Jr.</i> .....S	139	0	8
10	<i>Allen's No. 6</i> .....P	138	0	0
11	<i>Splendid</i> .....S	133	0	16
12	<i>Townsend's No. 30</i> .....P	130	0	22
13	<i>Cruse No. 9</i> .....S	129	0	12
14	<i>Allen's No. 14</i> .....P	127	0	3
15	<i>Riehl's No. 6</i> .....S	119	0	9
16	<i>Sherman</i> .....S	117	0	9
17	<i>Manchester No. 1</i> .....P	108	0	43
18	<i>Brandywine</i> .....S	107	0	18
19	<i>Leader</i> .....S	96	0	20
20	<i>Cyclone</i> .....S	94	11	4
21	<i>Aroma</i> .....S	93	0	12
22	<i>Shuckless</i> .....S	92	0	39
23	<i>Luther</i> .....S	84	17	1
24	<i>Random</i> .....S	83	7	0
25	<i>Rush</i> .....P	78	0	5
26	<i>Timbrell</i> .....P	74	0	29
27	<i>Saunders' Success</i> .....S	33	0	0
?	<i>Perkins' No. 2</i> .....S	*	.....	.....
?	<i>Columbia</i> .....S	*	.....	.....

#### EARLY VARIETIES.

Those which yielded a considerable portion of their crop before June 21 may be called early varieties. They are named in order of their productiveness, prior to June 21, in Table VII.

\* Record incomplete.

TABLE VII—EARLY VARIETIES RANKED ACCORDING TO YIELD  
PRIOR TO JUNE 21, 1894.

NAME.	Date of first picking.	Ounces yielded before June 21.	Total ounces yielded 1894.	Rank as to yield 1894.
<i>See No. 1</i> .....	June 18	40	139	8
Luther .....	June 18	14	84	27
Cyclone .....	June 20	10	94	24

All of these continued fruiting till after July 3. None of them show, as yet, signs of superiority over standard varieties now generally cultivated. *See No. 1*, as noted on a previous page, is inferior in size; its stems are short but its color is good.

## LATE VARIETIES.

Those varieties named in Table VI, which yielded a considerable portion of their crop after July 3, may be classed as late varieties. Some of the Station seedlings will be included in this list. Named in the order of their productiveness after July 3 they stand:

TABLE VIII—LATE VARIETIES RANKED ACCORDING TO YIELD  
AFTER JULY 3, 1894.

NAME.	Date of last picking.	Ounces yielded after July 3	Total ounces yielded 1894.	Rank as to yield 1894.
<i>Station No. 198</i> .....P	July 14	105	144	6
<i>Manchester No. 1</i> .....P	July 6	47	108	20
Beauty .....	July 14	44	142	7
Shuckless .....	July 14	36	92	26
<i>Station 205</i> .....S	July 14	31	49	33
<i>Station 204</i> .....S	July 14	29	44	36
<i>Riehl's No. 5</i> .....P	July 10	28	187	4
<i>Townsend's No. 30</i> .....P	July 10	28	180	12
Splendid.....S	July 10	21	133	11
Timbrell .....	July 14	21	74	32

It will be noticed that *Station No. 198* gave a remarkably large late yield. It is much more productive of late berries than is Gandy, so far as we can determine, but is inferior to Gandy in quality. It is very vigorous, of good dark color, large size and borne on long, strong stems. Four rows of this variety in blossom are shown in Plate I, which shows the strong upright fruit stems and large, vigorous leaves.

*Manchester No. 1* is medium to large in size and of a good scarlet color, but it is soft and poor in quality, at least that is its record for this season on our soil. It should be noted that the season was quite unfavorable to the development of high quality in strawberries.

Beauty seems to be worthy of further testing. It is indeed a beautiful berry, of bright scarlet color, medium size, fair quality, but rather soft.

#### LIST OF STRAWBERRIES FRUITED IN BEDS TWO YEARS OLD, EXCLUDING STATION SEEDLINGS.

Accomack, Advancer, Alabama, *Allen's No. 1*, *Allen's No. 3*, Alpha, Anna Forest, Arkansas Traveler, Beder Wood, Belle, Belle Bordelaise, Bessie, Beverly, Brandywine, Bubach.

California, Cameronian, Captain Jack, Chairs Favorite, Cheyenne, Clark (*Early Idaho*), Clyde, *Crawford's Seedling*, Crescent, *Crosby's 91*, *Curtis No. 15*, Custer, Dayton, Dew, D and D.

Edgar Queen, Edward's Favorite, *Engle No. 1*, Epping, E. P. Roe, Eureka, Everbearing, Farnsworth, Galerson, Gandy, Gandy Belle, Gen. Putnam, Glenfield, Greenville.

*Hall's Seedling*, Haverland, *Hazleton No. 1*, Herbert, Hoffman, *Holcomb's Seedling*, Hulburt, Improved Manchester, Johnston's Late, Jucunda, Kincks.

Latest of All, Laxton's Captain, Lennig's White, Louise, Mag-nate, May King, Meeks' (*Meeks' Early*), Michel (*Michel's Early*), Middlefield, Muskingum, Ohio Centennial, Oliver, Oregon Everbearing.

Parker Earle, Pawnee, *Phillips' Seedling*, Primate, Prince of Berries, Princess, Princeton Chief, Sandoval, Sharpless, Smeltzer (*Smeltzer's Early*), Smith, Southard, *Stayman's No. 3*, *Slaymaker & Son No. 19*, *Street's Seedling*, Swindle.

*Thompson's No. 9, Thompson's No. 40, Tippecanoe, Townsend's No. 2, No. 3, No. 9 and No. 20, Triomphe de Gand, Van Deman, West Lawn, Wilton.*

**Productiveness.** Of this list, the following 10 named in order of productiveness, were most productive in 1894 :

Bubach, Smith, Bessie, Kincks, *Townsend's No. 9*, Gandy, Jucunda, Beder Wood, Greenville, Smeltzer.

Taking into account the combined yield of 1893 and 1894 the following 10, named in order of productiveness, were most productive :

*Townsend's No. 9, Townsend's No. 20, Smith, Capt. Jack, Gandy, Greenville, Bubach, Beder Wood, Eureka, Michel.*

**Early Varieties.** When the berries of the above list are compared as to their season of ripening it is found that Michel still holds first rank as a very early berry, but, as is usually the case with very early berries, its total yield for the entire season is considerably less than that of the best mid-season berries.

Ranked according to the amount of their yield prior to June 21 the early varieties stand as follows : Michel, Smeltzer, *Curtis No. 154, Allen's No. 3, Alpha, Hoffman.*

**Late Varieties.** Ranked according to the amount of their yield after July 3, the late berries stand as follows : Gandy, Prince of Berries, *Thompson's No. 40, Ohio Centennial.* Gandy takes the lead as a late berry, but as is usually the case with very late berries, the total yield for the season is considerably less than that of the best mid-season varieties.

#### CONSIDERED WORTHY FURTHER TESTING.

Among the scores of new varieties recently tested here the following are worthy of special mention and are recommended for further testing.

Pistillate varieties :

Sunny Side, from Chas. S. Pratt, Reading, Mass.

Beauty, }  
*Haynes' No. 31,* } from J. H. Haynes, Delphi, Ind.

*Riehl's No. 5,* from E. A. Riehl, Alton, Ill.

*Townsend's No. 9,* from Geo. Townsend, Gordon, O.

Staminate varieties :

*Townsend's No. 2*, from Geo. Townsend, Gordon, O.  
Sherman, from J. H. Haynes, Delphi, Ind.

#### NUMBER OF VARIETIES TESTED IN 1894.

Exclusive of several hundred varieties of Station seedlings, there were grown at this Station in 1894, 164 varieties of strawberries. Of this number 33 fruited here for the first time, and 25 have not yet fruited.

#### STATION SEEDLINGS.

The brief report of the work of breeding strawberries for the purpose of originating new varieties which was given in bulletin 64 of this Station, afterward included in the annual report for 1893, elicited many inquiries concerning the Station seedling strawberries and their introduction. In reply to these inquiries it may be said that none of the Station seedlings have yet been disseminated, and it is expected that none of them will be disseminated till after they have fruited in 1895. Whether any will be sent out then will depend on the record they make next summer.

Whenever it is decided to distribute plants of the Station seedling strawberries, due notice will be sent to all names in this State on the bulletin list, and also to the Station Horticulturists in other States. The conditions under which the distribution is to be made will then be clearly set forth.

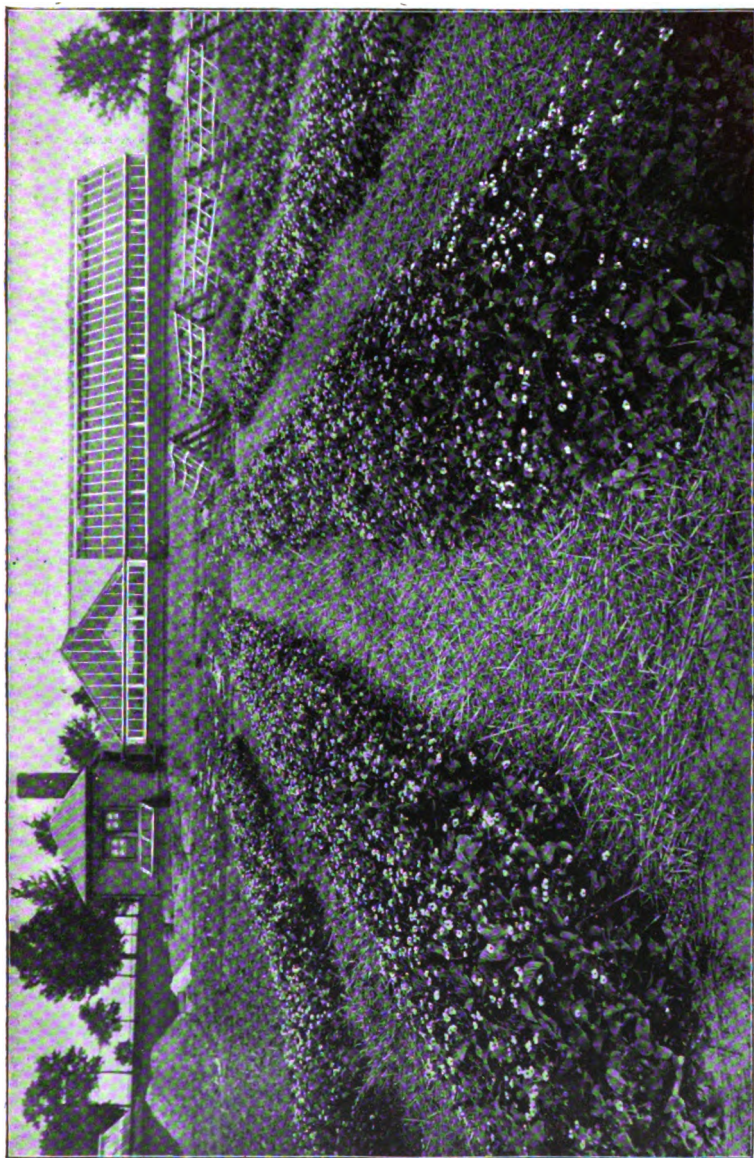


PLATE I.—Station seedling No. 198. (See page 650.)



## The Fertilization of Flowers in Orchards and Vineyards, Especially in its Relation to the Production of Fruit.

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[Presented at the Ontario Fruit-Growers' Association annual and winter meeting at Orillia, Ontario, Canada, December 6, 1894.]

It is a matter of common observation among fruit-growers that certain varieties of orchard and vineyard fruits show a remarkable difference in productiveness in different locations without sufficient apparent reasons for such a difference. I have in mind an apple orchard, 50 or more acres in extent, set chiefly to blocks of Baldwin and Greening, each block containing but a single variety in the main part of the orchard, but mingled somewhat with other varieties in one section. The orchard has been set about 25 years and has been a disappointment to its owners because, although it usually bears some fruit each year, it has produced but three or four good crops in all its history. In the sections where other varieties are mingled with the Baldwins, they have borne much more satisfactorily than have either the Baldwins or Greenings where they stand in blocks alone. The trees around the edge are thriftier and bear better than they do in the central portion of the orchard. In fact, the central portion of the orchard has never yet produced a good crop of fruit.

The owners think the trouble may be due to a combination of causes. The trees are planted but 30 feet apart, which is too close for mature trees. The soil in the central portion is thought to be naturally inferior to the soil in other sections, where the trees are more productive. Hordes of insects have devastated some portions of the orchard, and fungous diseases have not been wanting. While the orchard is not being impoverished by taking from it farm crops, neither is it being manured nor cultivated. So far as spraying or pruning is concerned, it receives much better treatment than most of the orchards in New York State. There seems to be good reason for believing that the trees are suffering from lack of nourishment, due to crowding them too closely together on land not in a high state of fertility;

to loss of foliage from insect pests and fungous diseases; to a lack of fertilizers and to absence of cultivation. But there is no difference in treatment of different portions of the orchard, so far as pruning, spraying, cultivation and fertilization of soil are concerned, and, therefore, the causes enumerated do not seem sufficient to satisfactorily account for the unproductiveness of varieties in certain sections, while the same varieties in other portions of the orchard are comparatively productive. The unfruitful portions consist of separate blocks of Baldwins and Greenings unmixed with other varieties, and some have thought that possibly on account of this isolation of each variety their blossoms have failed to set fruit.

A similar idea with regard to certain cultivated varieties of the native plum has long been entertained by some growers of that fruit in the Mississippi valley and other portions of the Great Central plain.<sup>5</sup> This idea is founded on observations that varieties such as Wild Goose and Miner set but little fruit when standing alone, although they blossom abundantly, while they are more productive when standing near other varieties, from which their flowers may be assisted to set fruit.

Prof. Goff has shown<sup>6</sup> that with some kinds of native plums failure to set fruit may be partly due to imperfections in the flowers, which render them incapable of setting fruit, but this does not account for those instances where a tree that was formerly barren becomes fruitful when another variety, blossoming at the same time, is planted near it. In such cases it appears that the flowers are capable of setting fruit although they are incapable of setting fruit of themselves.

Some horticulturists have for many years believed that a similar condition of affairs also exists with certain cultivated grapes, especially with some of the hybrid varieties. Within the last three years I have been able to demonstrate that this belief is, in many instances, well founded. Mr. M. B. Waite, of the United States Division of Vegetable Pathology, began a similar line of investigations in 1891, which resulted in showing that many varieties of pears, including some of the standard sorts, are incapable of setting fruit of themselves, a condition, so far as I am aware, that was wholly unsuspected by either practical or scientific horticulturists.

<sup>5</sup> Hansen, N. E. The Blossoms of Orchard Fruits; Trans. Iowa Hort. Soc'y, 1893, p. 155.

<sup>6</sup> Flowering and Fertilization of the Native Plum. Garden and Forest, vol. VII, 1894, pp. 262, 263.

It appears, then, that in considering the unfruitfulness of grapes and pears a new factor must be taken into account, since it has been shown that a failure to fruit may sometimes be the result of the inability of the blossoms to set fruit of themselves. We have also seen that there is some reason for believing that this cause of unfruitfulness is not peculiar to pears and grapes only, but that possibly it extends to other varieties of fruits as well. This brings us to the consideration of a subject that is coming more and more to be esteemed of a great practical importance to fruit growing, namely: The fertilization of flowers in orchards and vineyards, especially in its relation to the production of fruit.

### Parts of a Flower.

First, it may be well to illustrate, or define briefly, the meaning of a few botanical terms which are convenient to use in a discussion of this subject.

In general the flowers of orchard and garden fruits are what botanists call perfect—that is, they contain both the male and female organs. The male organs produce an abundance of fine yellow powder called pollen. The female organs, called pistils

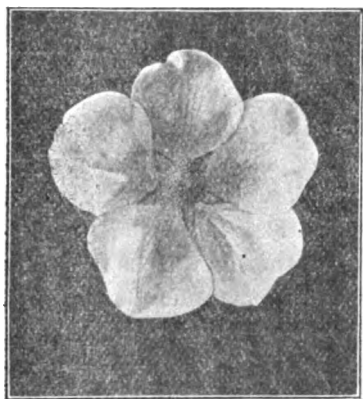


FIG. 1.—Imperfect Strawberry Blossom.

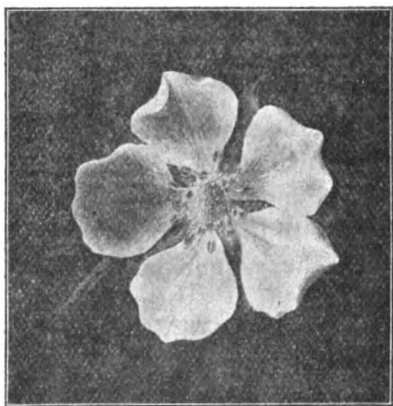


FIG. 2.—Perfect Strawberry Blossom.

contain the rudimentary seeds. These parts are well illustrated in the accompanying figures of the strawberry blossom. The outer green leaves of the blossom and the inner white ones of more delicate texture protect the organs in the center of the flower till they are fully developed. Then the flower opens and the showy white leaves help to attract insect visitors, which

assist in fertilizing the blossoms by carrying the pollen from one flower to another. But the green and white leaves are not essential to the production of fruit, for they may all be removed and still perfect fruit may be formed. In fact this frequently happens in artificially crossing fruits, when in removing the male organs above referred to as producing the pollen, the flower leaves are all cut away before the bud opens, thus leaving simply the female organs called pistils, which occupy the center of the blossom.

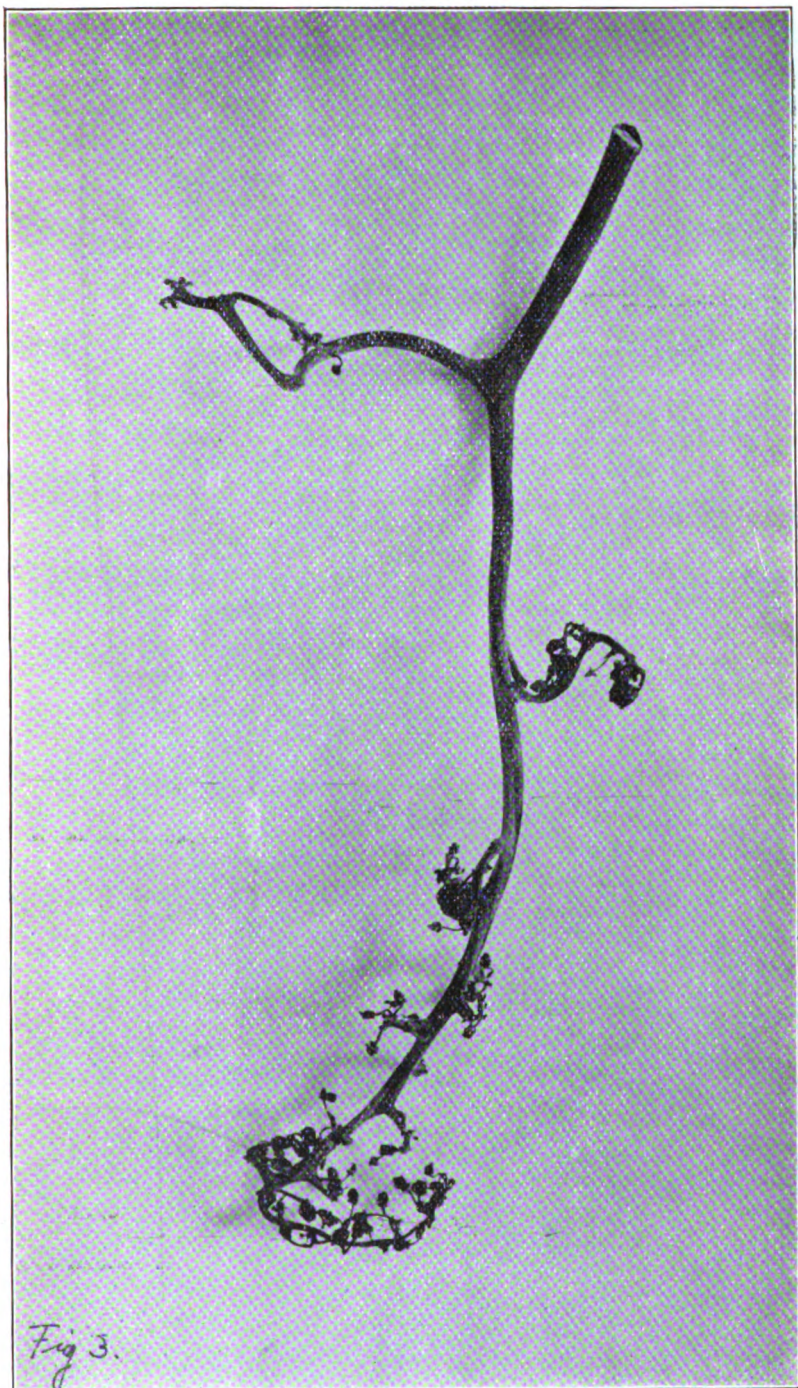
In the center of the blossom the pistils are located, as shown in Fig. 1. But this figure shows a flower that is imperfect because it bears the female organs, the pistils, but has none of the male organs, the stamens. Fig. 2 illustrates a strawberry blossom that is called perfect because it has both male and female organs. The stamens are here seen immediately surrounding the pistils in the center of the flower. The stamen consist of a slender thread or filament terminating in a tiny pouch or sack, which is filled with the yellow powder called pollen. The single grains of pollen are so small as to be scarcely visible.

The character of grape blossoms and their peculiar method of opening is briefly discussed in the annual report of this Station for 1893, p. 597.

When the flowers open and the pistils are ready to receive the pollen, the end of the pistil becomes slightly moist and sticky, so that the pollen readily adheres to this portion of the pistil when it comes in contact with it. The pollen grains thus finding lodgment sprout and send out a minute tube, which grows down into the central portion of the pistil till it reaches and fertilizes the rudimentary seeds contained therein. This is briefly the process of fertilization as that word is applied to flowers. After being fertilized, the rudimentary seeds begin to develop into seeds, and the surrounding portions of the embryo fruit are thereupon incited into growth. On the contrary, if the pistil is not supplied with pollen it soon withers, and no fruit is formed. In this connection it is not necessary to consider those unusual cases where fruit is developed without the action of pollen.

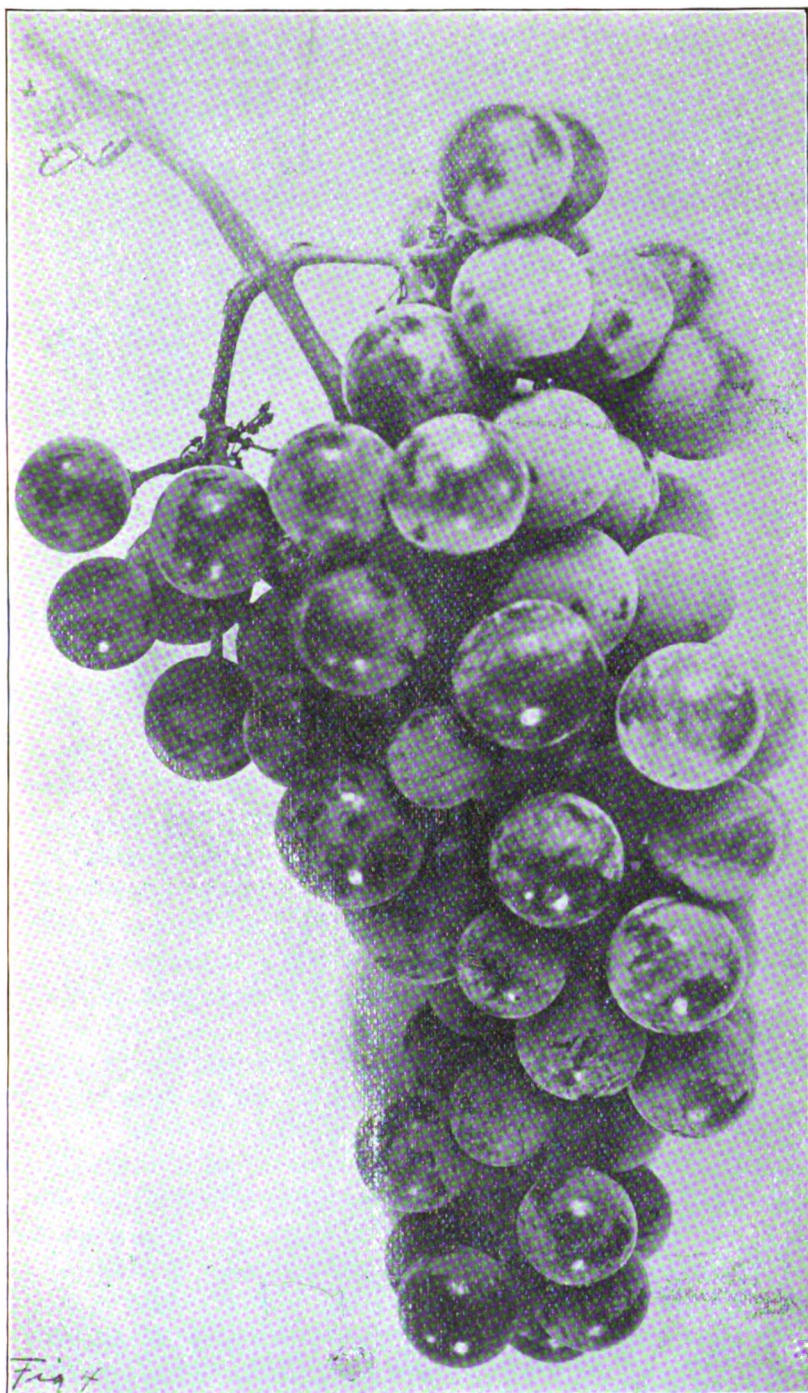
### **Experiments with Grapes.**

As stated before, for many years certain horticulturists have held the opinion that occasionally varieties of grapes were found in cultivation that were more prolific when standing in proximity to



**Fig. 3. Black Eagle, Self-Fertilized.**





**Fig. 4.—Black Eagle, Open to Cross Fertilization.**



another variety that blossomed at the same time, than they were when standing alone. In 1891 I planned to investigate this subject the following season, and the investigations then begun have been continued every season since that time. As primarily planned the object of the investigations was to determine, if possible :

1. Whether the pistil of the grape flower is pollinated before the blossoms open.

2. Whether any varieties are incapable of setting fruit when supplied only with their own pollen.

Observations<sup>7</sup> on seventy-seven kinds of grapes, including eight species and their hybrids and crosses, showed that, in every instance, self-pollination occurred, so that with these varieties, at least, failure to set fruit could not be attributed to lack of pollination. Twenty-one of these seventy-seven kinds of grapes can not fruit when supplied with none but their own pollen, while they are able to set fruit when planted near other varieties that blossom with them. With these varieties failure to fruit must result when set by themselves out of the reach of pollen from other vines.

The second question, namely, whether any varieties are incapable of setting fruit when supplied with none but their own pollen, is evidently one to be fully decided only by experiment. Investigations concerning this subject were made by covering the blossom clusters with paper bags before the blossoms opened. The bag was slipped over the cluster and the mouth was then drawn together and fastened with a wired label. After the blossoming season had passed, the paper bags in some instances were replaced with bags made of cheese cloth or mosquito netting. In other cases the paper bags were allowed to remain till the fruit was gathered. The object of this use of the paper bags was to exclude all outside pollen from the covered clusters, so that whatever fruit set within the bags would be the result of close fertilization ; that is to say, the pollen necessary to fertilization of the flower would be produced either by the flower itself or by some other flower in the same cluster.

Treated in this manner some varieties were able to fruit perfectly ; other varieties failed to develop any fruit whatever, and between these two extremes there was every gradation. Fig. 3 from a photograph of Black Eagle covered to exclude pollen of

<sup>7</sup> Beach, S. A. *The Self Pollination of the Grape. Garden and Forest* (1898), pp. 451, 452 ; also, *Annual Report of N. Y. State Experiment Station, Geneva, N. Y., for 1898*, pp. 597, 608.

other varieties, shows how this variety fails to fruit under such circumstances. Only a few blossoms of the cluster set fruit, and these remained till the close of the season as withered or abortive specimens. Fig. 4 is from a photograph of a Black Eagle cluster produced in a mixed vineyard, where the blossoms were exposed to the access of foreign pollen. At the base of the cluster appear a few rudimentary berries, which, for some reason, failed to develop, probably because they were not properly pollinated.

Fig. 5 is from a photograph of a self-fertilized cluster of Delaware showing how perfectly this variety can set fruit when standing alone. Fig. 6 from a photograph of a Duchess illustrates a variety that produces imperfect and unsatisfactory clusters when self-fertilized.

In order to present here some of the results of the tests of self-fertility of grapes mentioned above, an attempt has been made to classify the varieties according to their ability to set fruit as follows:

Class I. Fully self-fertile apparently not more than three blossoms in one hundred failing to set fruit. See Fig. 5.

Class II. Partly self-fertile, having rather loose clusters or a few abortive berries, but bunches after all being nearly perfect. This class may be called practically self-fertile.

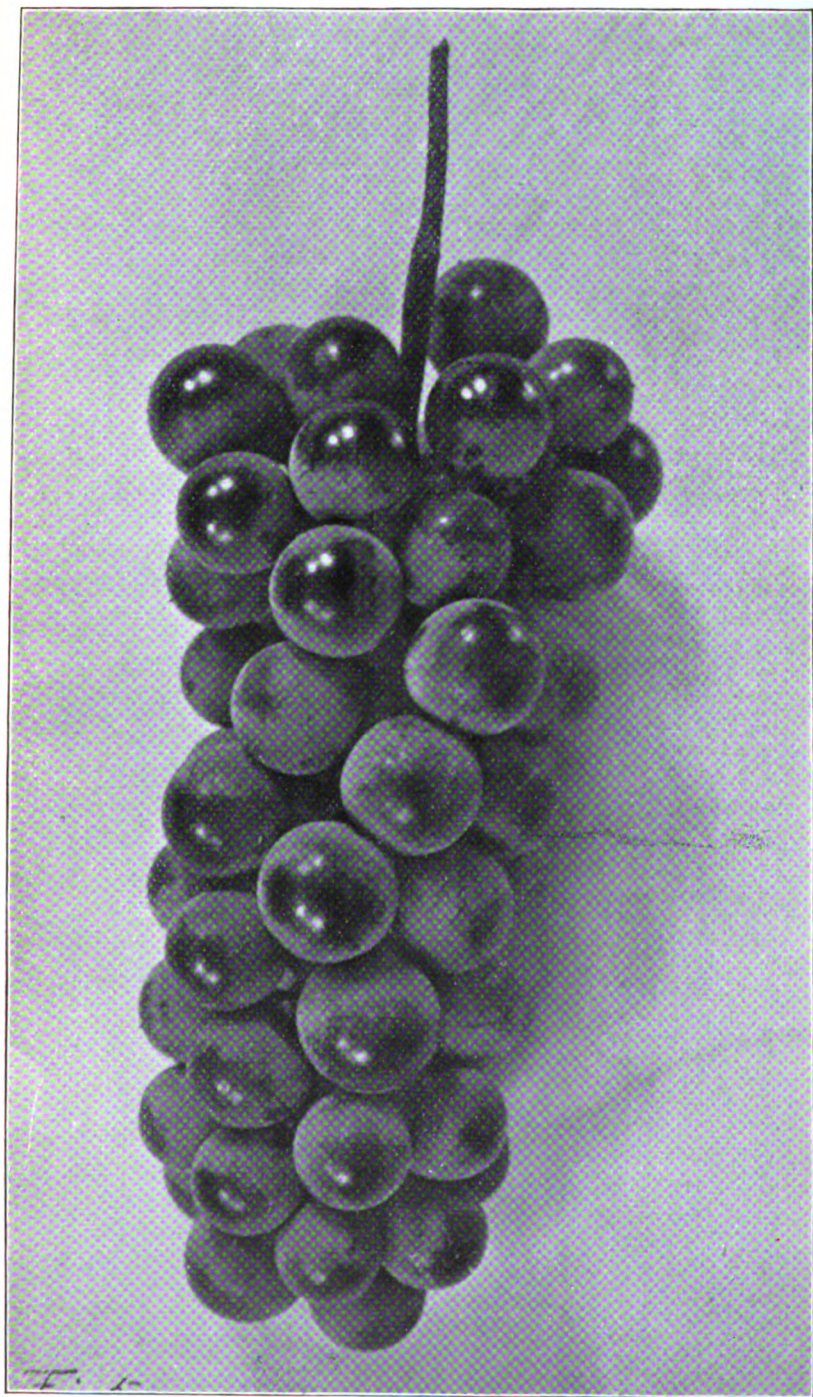
Class III. Clusters imperfect. The vines in this class were able to set some fruits but the clusters were usually imperfect and unsatisfactory. See Fig. 6.

Class IV. Pollen self-irritant. Pollen efficient enough to incite a slight growth resulting in the production of some abortive berries, but no perfect fruit. See Fig. 3.

Class V. Pollen self-impotent. In this class the pollen had no appreciable effect on the pistils, not even abortive berries being formed.

In this and the following tables the character of the stamens when known is indicated as follows: "s" indicates that the stamens are short; "l" that they are long; those intermediate between these two classes are mentioned in a foot-note. Where self-pollination before the blossom opens has been observed, this is indicated by an asterisk. The classification is based wholly on the evidence of experiments made at this Station. Further testing is considered necessary to determine the classification of varieties marked with a question mark.

Class I. Grapes which are fully self fertile are named in the following table. By fully self-fertile is meant that so far as observed not more than 3 per cent. of the blossoms fail to set fruit.



**Fig. 5.— Delaware, Self-Fertilized.**





**Fig. 6.—Duchess, illustrating the Imperfect Clusters Borne by this Variety when Self-Fertilized.**



## CLASS I.—LIST OF GRAPES FULLY SELF-FERTILE.

Character of stamens.	Self-pollina- tion.	NAME.	Names of parents.	Species represented in percentage.
1	*	Ambrosia.....	Salem.....	vin. and Lab.
1	...	Croton.....	Delaware X Chas. de Fontainebleu.....	vin., Bourq. and Lab.
1	*	Delaware.....	Concord X Iona.....	Bourq. and Lab.
1	*	Diamond.....	Elvira.....	Lab.
1	*	Etta.....	Triumph.....	Lab. and vul.
1	*	Early Golden (Campbell).....	.....	Lab. and vin.
1	*	Herald.....	.....	Lab. (or Lab. X).
1	*	Janesville.....	Concord X Allen's Hybrid.....	Lab. and vul.
1	*	Lady Washington.....	Walter.....	Lab. and vin.
1	*	Mabel†.....	Delaware (X?).....	Lab. and Bourq.
1	*	Mary's Favorite.....	Clinton X Poughkeepsie Red.....	Lab. and Bourq. (and vin.?).
1	*	Metternich.....	.....	Vul. and Lab. and (Bourq.?).
1	*	Monroe.....	Concord.....	Lab. and ?
1	*	Moore's Early.....	Concord X Cassidy.....	Lab.
1	*	Niagara.....	Lindley.....	Lab. X (vin.?).
1	*	Opal.....	Iona X Delaware or Walter.....	Lab. and vin.
1	*	Poughkeepsie Red.....	Isabella.....	Lab. and (Bourq.?).
1	*	Prentiss.....	Elvira X Perkins.....	Lab.
1	*	Profitable.....	.....	Lab. and vul.
1	*	Rochester.....	Mammoth X Chasselas.....	Lab. (or Lab. X?).
1	*	Rogers, No. 18.....	Mammoth X Black Hamburg.....	Lab. X vin.
1	*	Rogers, No. 24.....	Mammoth X Black Hamburg.....	Lab. X vin.
1	*	Rogers, No. 82.....	Concord X Black Prince.....	Lab. X vin.?
1	*	Rutland.....	.....	Lab. X vin.
1	*	Senasque.....	.....	test.
1	*	Vitisestivalis.....	.....	Lab.
1	*	Winchell.....	.....	Lab.

Total 27. 100 per cent. of the list have long stamens.

\* Self-pollination occurs before the blossom opens.

† Further testing is necessary to decide whether or not this variety should be placed in this class.

CLASS II — GRAPES WHICH ARE PARTLY SELF-FERTILE BUT STILL PRACTICALLY CAPABLE OF FRUITING SATISFACTORILY ALONE ARE NAMED IN THE FOLLOWING LIST.

Character of stamens.	NAME.	Names of parents.	Species represented in parentage.
* * *	Agawam, <i>Rog. 15</i> .....	Mammoth X Black Hamburg .....	Lab. X vin.
* * *	Alice .....	.....	Lab.
* * *	Brilliant † .....	Lindley X Delaware .....	Lab. and vin. (and Bourq ?)
* * *	<i>Burrows No. 42c</i> .....	Concord X Jefferson .....	Lab.
* * *	Catawba .....	.....	Lab.
* * *	<i>Caywood No. 50</i> .....	.....	.....
* * *	Centennial .....	Eumelan .....	Lab. and vin.
* * *	Clinton .....	.....	vulp.
* * *	Concord .....	.....	Lab.
* * *	Cottage † .....	Concord .....	Lab.
* * *	Diana † .....	Catawba .....	Lab.
* * *	Early Market † .....	Elvira .....	Lab. and vul.
* * *	Elsinburg .....	.....	test.
* * *	Elvicand .....	Elvira X Candicans .....	cand. and vul. and Lab.
* * *	Elvira .....	Taylor .....	vul. and Lab.
* * *	Empire State .....	Hartford X Clinton .....	vul. X Lab.
* * *	Golden Grain .....	Lindley X Delaware .....	Lab. and vin. (and Bourq ?)
* * *	Hartford .....	.....	Lab.
* * *	Highland .....	Concord X Jura Muscat .....	Lab. X vin.
* * *	Hopican .....	.....	Lab. and vin.
* * *	Isabella .....	.....	Lab.
* * *	Iona .....	Catawba .....	Lab.
* * *	Jefferson .....	Concord X Iona .....	Lab.

1	Jessica.....	.....	.....	Lab. (or Lab. X ?)
1	Little Blue.....	.....	.....	vin. and aest.
1	Mills.....	.....	Muscat Hamburg X Creveling.....	(Lab. and Bourq. ?)
1	Olita.....	.....	Delaware.....	Lab. (or Lab. X ?)
1	Paragon.....	.....	Concord.....	Lab.
1	Pocklington †	.....	Elvira X Triumph.....	Lab. and vin. and vul.
1	Rommel.....	.....	Delaware.....	(Lab. and Bourq. ?)
1	Standard.....	.....	Concord X Chasselas Musqué.....	Lab. X vin.
1	Triumph.....	.....	Catawba X aestivalis.....	Lab. X aest.
1	Ulster †	.....	.....	Lab.
1	Vergennes.....	.....	Concord.....	Lab.
1	Worden.....	.....	.....	Lab.

Total, 35. 100 per cent. have long stamens.

\* Self-pollination occurs before the blossom opens.

† Further testing is necessary to decide whether or not this variety should be placed in this class.

CLASS III — GRAPES WHICH ARE PARTLY SELF-FERTILE BUT SET FRUIT UNSATISFACTORILY WHEN ALONE, ARE NAMED IN THE FOLLOWING LIST.

Character of stamens.	Self-pollina- tion.	NAME.	Names of parents.	Species represented in percentage.
1	*	Adirondack .....	.....	Lab.
1	*	Amber Queen .....	Marion X Black Hamburg .....	vul. X vin.
8	*	Beagle .....	Elvira X Ives .....	Lab. and vul.
8	*	Canada .....	Clinton X Black St. Peters .....	vul. X vin.
1	*	Canonicus .....	.....	Lab. and vul.
1	*	Daisy .....	Gæthe .....	Lab. and vin.
1	*	Dracut Amber .....	.....	Lab.
1	*	Duchess .....	Wh. Concord X Delaware or Walter .....	Lab. and (Bourq. ?)
1	*	Eumelan .....	.....	(Lab. and vin. ?)
8	*	Geneva .....	(Wild Lab. X Mus. Alex'a) X Iona .....	Lab. and vin.
1	*	Nectar .....	Concord X Delaware .....	Lab. and (Bourq. ?)
1	*	Noah† .....	Taylor .....	vul. and Lab.
1	*	Perkins .....	.....	Lab.
1	*	Vitis Arizonica .....	.....	Arizonica
†	*	Vitis rupestris .....	.....	Rupestris.
8	*	Vitis Solonis var. Novo Mexicana .....	.....	Solonis var. Novo Mex.
8	*	Vitis Solonis .....	.....	Solonis.

Total, 17.

Of the 79 varieties of known stamens fruitful to some extent when standing alone, that are included in the three preceding classes, less than 8 per cent. have short stamens, and all these short stamen varieties are included in Class III, three of them being wild vines and three cultivated.

\* Self-pollination occurs before the blossom opens.

† Further testing is necessary to determine whether or not this variety should be placed in this class.

‡ Intermediate.

CLASS IV — GRAPES WHICH SET ABORTIVE FRUIT, BUT DO NOT PERFECT FRUIT, WHEN ALONE.

Character of stamens.	Self-pollina- tion.	NAME.	Names of parents.	Species represented in percentage.
s	*	Aminia, <i>Rog.</i> 39.....	Mammoth X Black Hamburg.....	Lab. X vin.
s	*	Black Eagle.....	.....	Lab. X vin.
s	*	Brighton.....	Concord X Diana Hamburg.....	Lab. and vin.
s	*	Essex, <i>Rog.</i> 41.....	Mammoth X Black Hamburg.....	Lab. X vin.
s	*	Gaertner, <i>Rog.</i> 14.....	Mammoth X White Chasselas.....	Lab. X vin.
s	*	Herbert, <i>Rog.</i> 44.....	Mammoth X Black Hamburg.....	Lab. X vin.
s	*	Massasoit, <i>Rog.</i> 3.....	Mammoth X White Chasselas.....	Lab. X vin.
s	*	Merrimack, <i>Rog.</i> 19.....	Mammoth X Black Hamburg.....	Lab. X vin.
s	*	Requa, <i>Rog.</i> 23.....	Mammoth X Black Hamburg.....	Lab. X vin.
s	*	Rogers, <i>No.</i> 5.....	Mammoth X White Chasselas.....	Lab. X vin.
s	*	Salem, <i>Rog.</i> 33.....	Mammoth X Black Hamburg.....	Lab. X vin.
?	....	Vitis cinerea.....	.....	cinerea.
s	*	Vitis Doaniana.....	.....	Doaniana.
s	*	Wilder, <i>Rog.</i> 4.....	Mammoth X White Chasselas.....	Lab. X vin.

Total, 14. Of the thirteen varieties in this list with known stamens, all have short or recurved stamens.

\* Self-pollination occurs before the blossom opens.

## CLASS V — GRAPES IN WHICH SELF-POLLINATION HAD NO PERCEPTIBLE INFLUENCE ON THE OVARY.

Character of	Self-pollination.	NAME.	Names of parents.	Species represented in parentage.
1	*	Aledo .....	Taylor .....	vul. and Lab.
1	*	Amber .....	Mammoth X Black Hamburg .....	Lab. X vin.
8	*	Barry, <i>Rog. 43</i> .....	Elvira X Triumph .....	Lab. and vin. and vul.
8	*	Blanco .....	Hartford X Bl. Hamburg .....	Lab. X vin.
8	*	Burnet .....	.....	Bourq.?
8	*	Clevener .....	.....	vin. and aet.
8	*	Creveling .....	Concord .....	Lab.
1	*	Eaton † .....	Concord X Allen's Hybrid .....	Lab. and vin.
8	*	Eldorado .....	Elvira X Bacchus .....	vul. and Lab.
8	*	Elvibach .....	Taylor .....	vul. and Lab.
1	*	Faith .....	Concord .....	Lab.
8	*	Hayes .....	A. Rog. Hybrid .....	Lab. and vin.
8	*	Hercules .....	Delaware .....	(Lab. and Bourq.?)
8	*	Jewel .....	Concord .....	Lab.
1	*	Lady .....	Mammoth X White Chasselas .....	Lab. X vin.
8	*	Lindley, <i>Rog. 9</i> .....	.....	vul.
8	*	Marion .....	.....	Lab.
8	*	Maxatawney .....	.....	Lab.
8	*	Norwood .....	Lindley X Champion .....	Lab. and vin.
8	*	Red Bird .....	Black Eagle .....	Lab. and vin.
8	*	Red Eagle .....	Delaware X Martha .....	Lab. and (Bourq.?)
8	*	Roscoe .....	.....	Champini.
8	*	Vitis Champini .....	.....	

Total, 23. Seven, or 30 per cent. of the above list, have long stamens; 16, or 70 per cent. of the above list, have short or recurved stamens.

\* Self-pollination occurs before the blossom opens.

† Further testing is necessary to decide whether or not this variety belongs to this class.

These lists contain in all the names of one hundred and sixteen grapes, twenty-seven of which are fully self-fertile; thirty-five are partly self-fertile, but are able to fruit satisfactorily of themselves; seventeen are partly self-fertile and fruit unsatisfactorily of themselves; fourteen have pollen self-irritant only, and twenty-three show no appreciable development of the ovary as a result of self-fertilization.

For all practical purposes the varieties may be placed in three groups. The first group, including Classes I and II, contains those kinds which are able to fruit satisfactorily when standing alone. Of the one hundred and sixteen varieties mentioned in the preceding lists sixty-two, or a little more than one-half, are able to fruit satisfactorily when standing alone. Everyone of these self-fertile varieties has long stamens. In this group are found among others the following well-known kinds: Agawam, Catawba, Clinton, Concord, Delaware, Diamond, Diana, Elvira, Hartford, Isabella, Moore's Early, Niagara, Pocklington and Worden, and also Brilliant, Elvicand, Mills, Triumph and Winchell of the newer kinds.

The second group, indetical with Class III in the preceding lists, contains those varieties which are able to set some fruit, but when standing alone yield clusters that are imperfect and unsatisfactory. This group includes among others Beagle, Canada, Duchess and Eumelan.

The third group, including Classes IV and V, contains those varieties which when self-fertilized did not bring a single fruit to perfection. In it are found among other kinds Barry, Black Eagle, Brighton, Eldorado, Massasoit, Merrimack, Lindley, Salem and Wilder. Nearly all the varieties in this and the next preceding group are hybrids, but some are not. It will not do, however, to reason from this that hybrids can not bear fruit when self-fertilized, because two-thirds of the first group are hybrids. Neither are we prepared to say that all cultivated varieties belonging purely to one species are able to fertilize themselves, since some few varieties that are not commonly thought to be hybrids can not fruit alone.

Rarely have varieties with short stamens been found that are able to set any fruit of themselves, and even then the clusters are

very imperfect. Prof. Munson holds<sup>8</sup> that in all species of *Vitis* wild vines having flowers with short, recurved stamens are incapable of setting fruit of themselves.

While it would not be well to accept results of observations on but one hundred and sixteen varieties in one locality as conclusive for all varieties and localities, yet the observations are on a sufficiently extensive scale to be valuable in indicating what results may be expected from wider observations. They indicate that

1. Only cultivated varieties of grapes having long stamens may be expected to fruit satisfactorily by themselves.

2. Not all varieties with long stamens are able to fruit satisfactorily by themselves.

3. Varieties having short or recurved stamens and other self-sterile sorts if grown at all ought to be intermingled with other vines that blossom at the same period.

4. Most of the varieties incapable of setting fruit of themselves are hybrids.

5. Many hybrids are capable of setting fruit satisfactorily of themselves.

6. The failure of grapes to set fruit of themselves, as far as may be determined from these investigations, is not for lack of pollination. Observations have been made on fifty-three of the fifty-four varieties which were noted as setting fruit of themselves unsatisfactorily, or not at all, and in every instance self-pollination occurred before the blossoms opened.

7. Blossoms which are not incited to develop fruit by the action of their own pollen may fruit satisfactorily when supplied with pollen of some other variety. This is shown not only by experiments where the blossoms of such varieties were hand pollinated with pollen from some other variety, but also by abundant evidence of their fruiting in mixed vineyards where they are exposed to the access of pollen from other varieties. Thus Barry, Eaton, Eldorado, Lindley, Brighton, Black Eagle, Gærtner, Herbert, Merrimack, Salem and Wilder proved in these experiments utterly incapable of perfecting fruit when supplied only with their own

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<sup>8</sup> Beach, S. A.—Notes on Self-pollination of the Grape. Annual Report N. Y. Agri. Expt. Station, Geneva, N. Y., 1892, p. 604.

pollen, yet they are quite generally valued as amateur varieties, and some of them are occasionally planted in commercial vineyards.

In these investigations with grapes it has been shown that although a pistil may be plentifully supplied with pollen from its own blossom, yet in self-sterile varieties no fruit is developed as a result of such pollination. In other species of plants similar instances have long been known. In such cases unfruitfulness is not due to a lack of pollen, but to a lack of the right kind of pollen. In many observed instances, when the pistils of self-sterile plants are supplied with pollen from some other variety of the same species, or even of some nearly related species, fruit is produced.

Another interesting fact is that the pollen which is powerless to incite fruitfulness on flowers of its own variety may be able to fertilize the blossoms of some other variety. I have had currants develop fruit when the pistil was supplied only with gooseberry pollen and *vice versa*, and pears when supplied only with apple pollen; others have reported that peach blossoms set fruit when supplied only with cherry pollen. These may be considered rather extreme cases, and in such instances the resulting fruits are apt to be seedless. More nearly related species, as, for example, the different species of grapes or the different species of gooseberries, produce seeds quite readily when fertilized by each other in this way.

Evidently the fruitfulness of a self-sterile variety may be accounted for by the proximity of a supply of congenial pollen, even though it be produced by a plant not of the same, but of some nearly related species, so that, while the production of fruit depends on a supply of congenial pollen, that supply does not always come from blossoms of its own variety, but may come from other varieties or even from other species.

From what has been said it ought not to be inferred that in all instances where trees are unfruitful when standing alone the difficulty is due to the lack of congenial pollen for fertilizing their blossoms. It would be easy, for example, to show that many varieties of fruits are less productive when standing alone than when mingled with other varieties in a well-cultivated

orchard, but this does not necessarily prove that the reason for its unfruitfulness when isolated is for lack of proper pollination of its blossoms, for it usually happens that it has much better care in the orchard where it becomes some one's business to look after its welfare than it has when standing alone where it is apt to be somewhat neglected. In making comparisons of this kind all conditions which may influence the fruitfulness of the plant ought to be taken into consideration, and conclusions should be drawn only from carefully conducted experiments.

In conclusion it should be said that this essay presents simply a contribution to our knowledge of the fertilization of grape blossoms. As yet but little is known concerning the fertilization of flowers in orchards and vineyards, a subject which presents a wide field for investigation and promises to careful workers results of great practical importance to horticulture.

Since it is true that some varieties of fruits come into favor while growing in mixed plantations and afterward bring disappointment and loss when relying on such records they are set in extensive plantations by themselves, then before isolating a variety in large plantations it is the part of wisdom to learn whether or not it is capable of fruiting satisfactorily by itself.

On the other hand, the knowledge that in some instances isolation of a variety is a cause of unfruitfulness should not incite us to attribute to this cause the many experiences with unfruitful trees or vines that have lightened our purses in years past, making of it a scapegoat on whose devoted head we solemnly lay all our sins of omission and commission in our treatment of the orchard or vineyard. While we know that this is a possible cause of unfruitfulness, we should be none the less careful to employ all other means conducive to the development of vigorous, fruitful plants which the science and art of horticulture have placed at our command, such as a study of the adaptation of different varieties to different soils and climates, the cultivation and fertilization of the soil, pruning, thinning the fruit and spraying for the prevention of fungous diseases or for the destruction of insect pests.

## Treatment of Pear Scab\* in 1894.

Experiments in treating pear orchards with a view to preventing the injury of the fruit by the fungus which causes pear scab were undertaken by the Station Horticulturist in 1894 for the purpose of gaining information concerning the following questions:

1. What is the least number of treatments with Bordeaux mixture, 1 to 11 formula,<sup>9</sup> which will practically prevent injury from

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\* *Fusicladium pyrinum* (Lib.) Fck'l.

<sup>9</sup> With this formula one pound of copper sulphate and the necessary amount of lime are used to make 11 gallons of the mixture; this formula may also be expressed as one kilogram of copper sulphate and the necessary amount of lime to make about 110 litres of the mixture.

No simple means of indicating the strength of Bordeaux mixtures has as yet come into general use. The expression used above is simple and readily understood. The unit of weight by which the amount of copper sulphate is determined is first stated and then the amount of Bordeaux mixture which is made with this amount of copper sulphate is given. Thus, "1 to 8 formula" means that one pound of copper sulphate is used in making eight gallons of the mixture; "1 to 6 formula" means that one pound of copper sulphate is used in making six gallons of the mixture, etc.

In practical field work the only ingredient of Bordeaux mixture that must be accurately weighed is the copper sulphate. The necessary amount of lime is readily determined by means of the potassium ferrocyanide test. The simplest way, therefore, to express the strength of different formulæ is, as just stated, by giving first the unit of weight of copper sulphate and then the measure of the mixture which is made from the given amount of copper sulphate.

In recent publications of the United States Department of Agriculture, the strength of different formulæ for the Bordeaux mixture is expressed in terms of the formula first used extensively in the work of that Department, namely, "six pounds of copper sulphate, four pounds of lime and 22 gallons of water," which is set up as a standard formula to which all others are referred. In this case six pounds of copper sulphate are taken as a unit of measure in terms of which various other formulæ are to be expressed. According to this plan a "60-gallon formula" means that six pounds of copper sulphate are used in making 60 gallons of Bordeaux mixture. Would not "the 1 to 10 formula" be a more simple expression for the same thing?

The use of Bordeaux mixture is spreading rapidly among farmers and fruit-growers, who know nothing of the "six pounds of copper sulphate, four pounds of lime, for 22 gallons of mixture" formula thus arbitrarily selected as "standard" to which all other formulæ are to be referred. Such terms as "a 60-gallon formula" may be readily understood by those who are quite familiar with the history of the use of the Bordeaux mixture in America, but to the vast majority of users of the mixture who are not posted as to the terms of the "standard" formula such an expression must be quite confusing, especially since the "standard" formula is now little used in practical work. For these reasons it seems desirable in referring to various formulæ for the Bordeaux mixture to state first the unit of weight in determining the quantity of copper sulphate to be used and then state the amount of Bordeaux mixture which is made with this amount of copper sulphate.

the scab in pear orchards and at what time in the season ought the treatment to be made?

2. To what extent is late spraying liable to cause russetting or roughness of the fruit?

3. To what extent will the benefits of spraying one season influence the crop of the next season?

It should be noted that this discussion of the treatment of pear scab applies simply to orchards. The methods of treatment which have proved successful in orchards are not wholly applicable to the treatment of pear seedlings or pear nursery stock.

### INVESTIGATIONS OF 1893.

The experiments of 1894 were a continuation of similar work by the Horticulturist in 1893, and the questions above proposed for investigation suggested themselves in considering the results of that work.<sup>10</sup>

Two questions were selected for investigation in 1893. The first was whether the pear scab could be practically prevented by the use of Bordeaux mixture diluted to the 1 to 11 formula?<sup>11</sup>

The second was whether three treatments before the blossoms open are preferable to two treatments before the blossoms open. As a result of these investigations it was demonstrated that this dilute Bordeaux mixture, when thoroughly applied, is a practical preventive of pear scab. But little difference was observed in the per cent. of first-class fruit obtained from the sections sprayed three times before blossoming and that obtained from the sections sprayed twice before blossoming, so that it was considered doubtful whether enough benefit was derived from the extra treatment to justify its expense. Three treatments were made after blossoming, making the total number of treatments for the season six in one set of experiments and five in the other. When it was shown that this treatment was effectual in preventing the scab the question then arose whether or not this was the least number of applications of Bordeaux mixture of this strength necessary to do the work satisfactorily.

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<sup>10</sup> The results of the experiments of 1893 were published in Bulletin 64 of this Station and also in the Annual Report for 1893, pp. 694 to 717.

<sup>11</sup> See note, page 649.

## NUMBER OF TREATMENTS NECESSARY.

## Investigation of 1894.

In order to determine this point it was desired to conduct the experiments of 1894 on an extensive scale, the same as in 1893, in order to avoid erroneous conclusions which are liable to appear when only a few trees are included in an experiment.

Through the kindness of Messrs. E. Smith & Sons, Geneva, N. Y., the pear orchard of about 42 acres which was used for the experiments of 1893 was again placed at the disposal of the Station for experimental purposes in 1894. The writer wishes here to acknowledge his indebtedness to them for this courtesy and especially to Mr. W. A. Smith whose cordial co-operation in all the plans of the experiments has assisted materially in securing the results that were obtained.

The pear orchard in which the experiments were conducted is located not far from the Station grounds on the upland about two miles west of Seneca lake. The original trees are nearly 30 years old. Vacancies have occurred at different times and their places have been filled with trees of the same or other kinds of pears, or with plums. Occasional trees of the following varieties, therefore, occurred in the experimental plot, as indicated in the accompanying plan, namely : Anjou, Bartlett, Bosc, Clairgeau, Lawrence and Sheldon.

*Diagram of Pear Orchard Showing Location of Treated and  
Untreated Trees.*

.	2	0	.	.	.
.	0	0	.	.	.
.	0	0	0	0	0
6	0	0	.	.	.
0	0	9	.	.	.
7	.	0	.	0	.
0	.	2	0	.	.
.	.	0	.	.	.
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8	0	0	.	.	.
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*	.	0	*	.	.
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*	0	0	.	0	3
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*	.	0	.	1	*
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.	.	.	1	*	*

EXPLANATION OF DIAGRAM.

- \* Seckel sprayed.
- 0 Seckel not sprayed.
- 1 Clairgeau sprayed.
- 2 Clairgeau not sprayed.
- 3 Anjou not sprayed.
- 4 Bosc not sprayed.
- 5 Lawrence sprayed.
- 6 Lawrence not sprayed.
- 7 Bartlett not sprayed.
- 8 Sheldon sprayed.
- 9 Sheldon not sprayed.
- . Pears not in full bearing, plums or vacant places.

Six rows were included in the experimental plot, each row of which, if no vacancies occurred, would contain 36 trees. The number of trees included in the experiment is 118, 63 of which were sprayed and 55 were left unsprayed for the purpose of comparison.

For the purpose of comparing the effects of treatment at different periods in the season, the treated trees were divided into four sections, namely :

Section I, containing 20 Seckels. It was given treatments 1, 2, 3, 4 and 5.

Section II, containing 14 Seckels. It was given treatments 1, 2, 3 and 4.

Section III, containing 8 Seckels. It was given treatments 2, 3, 4 and 5.

Section IV, containing 17 Seckels. It was given treatments 2, 3 and 4.

Section V, containing 18 Seckels. It was left untreated for comparison with I and II.

Section VI, containing 24 Seckels. It was left untreated for comparison with III and IV.

All trees in the experimental block were treated alike throughout the season, except with regard to spraying. The spraying was done on the following dates :

1. April 25, immediately after the fruit buds<sup>12</sup> began to open. See figure 1, plate II.

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<sup>12</sup> Those who have watched the opening of pear buds will remember that the buds commonly called "fruit buds" open first, disclosing slender leafy bracts and a cluster of blossom buds, as shown in figure 1. At this time the leaf buds show green only at the tips where they are breaking through the bud scales. The length of time that elapses between the opening of the fruit buds and the opening of the blossoms varies according to the weather conditions, but in this latitude it is usually about 10 days.

## PLATE II.

### EXPLANATION OF PLATE.

*Reproduced from photographs.*

Fig. 1. Seckel pear twig showing the condition of the buds at the time of the first spraying, April 25, 1894.

Fig. 2. Seckel pear twig showing condition of blossom buds at the time of the second spraying, May 3 and 4, 1894.

Fig. 3. Seckel pears showing the condition of the fruit at the time of the third spraying, May 15, 1894.

## PLATE III.

### EXPLANATION OF PLATE.

*Reproduced from photographs.*

Fig. 4. Seckel pears showing the condition of the fruit at the time of the fourth spraying, June 5, 1894.

Fig. 5. Seckel pears showing the condition of the fruit at the time of the fifth spraying, June 21, 1894.



**PLATE II.— Showing development of blossoms at different periods of spraying.**



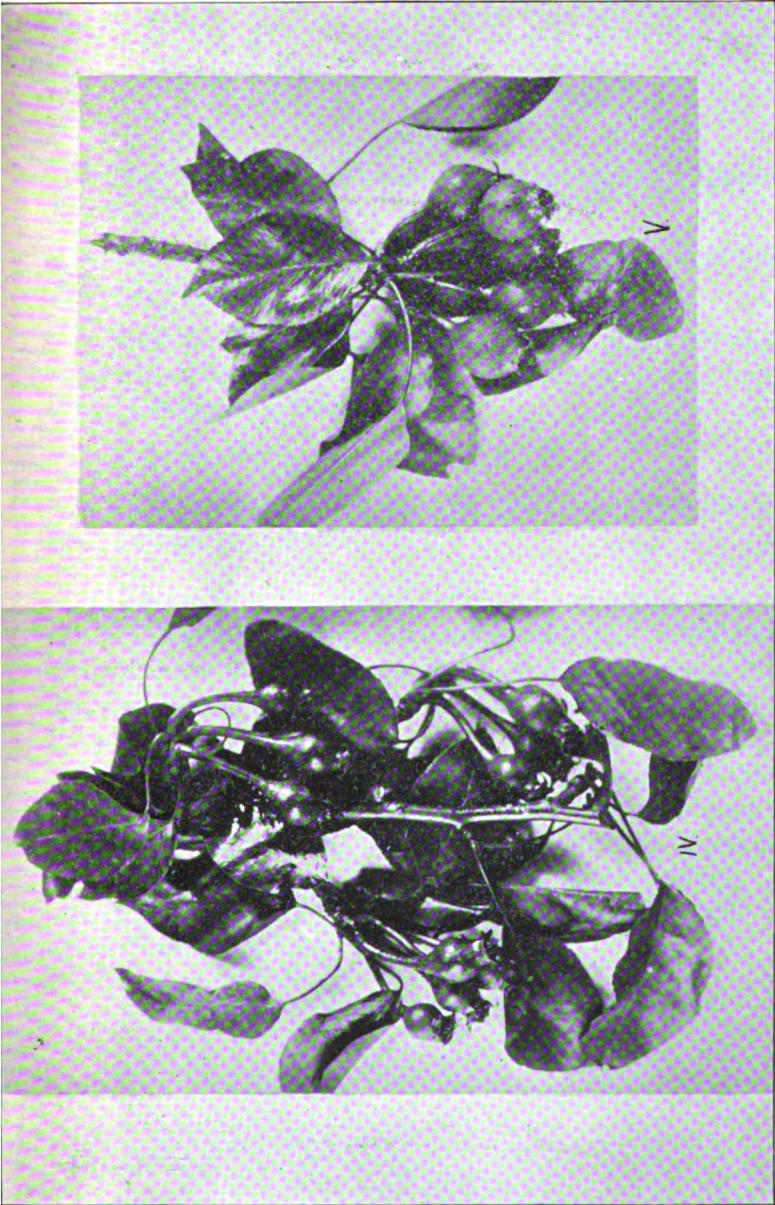


PLATE III.— Showing condition of fruit at different periods of spraying.



2. May 3 and 4, immediately before the blossoms opened. See figure 2, Plate II.

3. May 14 and 15, immediately after the blossoms fell. See figure 3, Plate II.

4. June 6. This treatment was delayed about 10 days later than was intended, because rainy weather prevented its application. See figure 4, Plate III.

5. June 21. See figure 5, Plate III.

6. June 21. Application was also made to one tree that had not been previously sprayed.

All Seckel fruit was picked October 1 and sorted according to Mr. Smith's usual custom. A small quantity of select fruit was secured from a few of the unsprayed trees, otherwise the fruit was sorted into the following classes, namely, No. 1, No. 2, No. 3,<sup>13</sup> and culls.

Fruit of good size and fair appearance was put in the No. 1 grade; fruit of medium size or large sized fruit with some imperfections was put into the No. 2 grade; small fruit, if marketable, went into No. 3 grade. The culls were not marketed. In the following comparison no account is taken of the fruit of any variety except Seckel.

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<sup>13</sup> In some instances this grade between No. 2 and culls was made.

TABLE IX — COMPARISON OF YIELDS BY GRADES.

	Selects.	No. 1.	No. 2.	No. 3.	Culls.	Total.
Sections I and II, 29 Seckels ; sprayed twice before blossoming (bushels).....	.....	38	33	3	5.5	79.5
Average yield per tree (bushels).....	.....	1.31	1.13	.11	.19	2.74
Per cent. of yield in each grade.....	.....	48	41	4	7	100
Sections III and IV, 24 Seckels ; sprayed once before blossoming (bushels).....	.....	43	16	2.75	3.25	65
Average yield per tree (bushels).....	.....	1.79	.66	.11	1.14	2.7
Per cent. of yield in each grade.....	.....	66	25	4	5	100
Sections V and VI, 43 Seckels ; unsprayed (bushels).....	2.25	12.5	54.75	.....	17.75	87.26
Average yield per tree (bushels).....	.05	.29	1.27	.....	.41	2.02
Per cent. of yield in each grade.....	3	14	63	.....	20	100
Sections I and III, 24 Seckels ; sprayed three times after blossoming (bushels).....	.....	27	23	3	2	55
Average yield per tree (bushels).....	.....	1.13	.96	.13	.08	2.3
Per cent. of yield in each grade.....	.....	49	42	6	3	100
Sections II and IV, 29 Seckels ; sprayed twice after blossoming (bushels).....	.....	54	26	2.75	6.75	89.5
Average yield per tree (bushels).....	.....	1.86	.90	.09	.23	3.08
Per cent. of yield in each grade.....	.....	60	29	3	8	100

Combining the yields of sections I and II which were sprayed twice before blossoming, the yields of sections III and IV which were sprayed once before blossoming, and the yields of sections V and VI which were unsprayed, the average per cent. of fruit in each grade is determined as shown in the following table :

TABLE X.—COMPARING THE VALUES OF ONE WITH TWO TREATMENTS BEFORE BLOSSOMING.

	Selects.	No. 1.	No. 2.	No. 3.	Culls.	Average yield per tree.
Sections I and II, sprayed twice before blossoming (per cent.)	.....	48	41	4	7	.....
Sections I and II, sprayed twice before blossoming (bushels).	.....	1.32	1.2	.11	.19	2.74
Sections III and IV, sprayed once before blossoming (per cent.)	.....	66	25	4	5	.....
Sections III and IV, sprayed once before blossoming (bushels)	.....	1.8	.68	.11	.13	2.70
Sections V and VI, unsprayed (per cent.)	3	14	63	.....	20	.....
Sections V and VI, unsprayed (bushels)	.06	.28	1.27	.....	.41	2.02

The superiority of the sprayed over the unsprayed is evident, the first-class fruit being nearly three times greater in I and II than in the unsprayed sections, and nearly four times greater in III and IV than in the unsprayed sections. The first-class unsprayed fruit was smoother and brighter in appearance than the sprayed fruit. On a few unsprayed trees a considerable amount of fruit was found that graded as selects, but not enough of the select sprayed fruit was found to pay for the trouble of keeping a separate grade of it. The average yield per tree was from .68 bushel to .72 bushel greater in sprayed sections than in unsprayed sections. The injury to the fruit from spraying will be discussed on subsequent pages.

Combining the yields of sections I and III which were sprayed three times after blossoming, the yields of sections II and IV which were sprayed twice after blossoming, and the yields of sections V and VI which were unsprayed, the per cent. of fruit in each grade is determined as is shown in the following table:

TABLE XI—COMPARING THE VALUES OF TWO WITH THREE TREATMENTS AFTER BLOSSOMING.

	Selecta.	No. 1.	No. 2.	No. 3.	Culls.	Average yield per tree.
Sections I and III sprayed three times after blossoming (per cent.) .....	.....	49	42	6	3	.....
Sections I and III sprayed three times after blossoming (bushels) .....	.....	1.13	.96	.14	.07	2.30
Sections II and IV sprayed twice after blossoming (per cent.) .....	.....	60	29	3	8	.....
Sections II and IV sprayed twice after blossoming (bushels.) .....	.....	1.85	.89	.09	1.25	3.08
Sections V and VI unsprayed (per cent.) .....	3	14	63	.....	20	.....
Sections V and VI unsprayed (bushels) .....	.06	.28	1.27	.....	.41	2.02

The sections sprayed twice after blossoming had on the average 1.06 bushels more fruit per tree and *more than five times as much first-class fruit per tree* as did the unsprayed sections. The sections sprayed three times after blossoming had on the average .28 of a bushel more fruit per tree and nearly three times as much first-class fruit per tree as did the unsprayed sections. On the whole the results plainly show the superiority of sprayed over unsprayed trees, both in the quality and in the amount of the yield per tree.

When the trees sprayed three times after blossoming are compared with those sprayed twice after blossoming, the latter are evidently superior to the former, having about three-quarters of a bushel more fruit per tree, nearly all of which is first class. There is nothing in these experiments to encourage the practice of treating the trees for scab more than twice after blossoming. These results, it will be remembered, were obtained from Seckels only. I am inclined to believe that with varieties that are injured so badly by the scab as White Doyenne, a third treatment after blossoming will be found profitable, except perhaps in those seasons when there is reason to anticipate injury from spraying. The injurious effects observed in many instances as a result of spraying the past season will be considered on subsequent pages.

The testimony of Table X is in favor of one thorough treatment after the fruit buds open but before blossoming. Nearly a half bushel more first-class fruit per tree was secured this way than when two sprayings were given before blossoming. Judging from the results obtained in 1893, no injurious effects need be anticipated in an ordinary season from spraying even three times after the buds start in spring, but before the blossoms open. It may well be doubted, however, whether sufficient benefit is secured to justify the expense of more than one treatment at this period.

The testimony of Table XI even more strongly favors two rather than three treatments after blossoming, as shown above.

It will be remembered that at the time of the last treatment, June 21, an application was given to one tree that had not previously been sprayed (see page 655). The result showed practically no benefit from this late spraying. At the time the tree was sprayed both the foliage and the fruit were thoroughly

infested with the scab fungus, and on this account the spraying had no perceptible effect. This experiment simply adds to the already sufficient evidence establishing the fact that treatment of pear scab to be effectual must begin early in the season.

The methods of spraying used by this Station were employed by Mr. W. A. Smith in treating other parts of the orchard in which the experiments were conducted, and additional data were thus secured. Mr. Smith's treatment showed that:

1. Some trees sprayed but once, and that before the blossoms opened, showed some injury to the fruit as a result of the treatment. The injury became apparent during the rainy period that occurred the latter part of May and the first of June.<sup>14</sup> From May 16 to June 5, a period of 21 days, it rained every day.

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<sup>14</sup> Some idea of the climatic differences of late spring and early summer of 1894, as compared with 1893, may be obtained from the meteorological data taken from the records of observations made at the Station as shown in table XII on the following page. The Seckel pear blossoms began to open in 1893 on May 19, and in 1894 on May 8. The weather conditions from the blossoming time to the last of June includes the spraying season.

The lowest average amount of sunshine for the period referred to in 1893 was during the week from June 16 to June 22, when the sun shone but 31.9 per cent. of the time it was above the horizon, but in 1894, during the week from May 17 to May 23, there was but 23 per cent. of the possible amount of sunshine, and during the following weeks but 14 per cent. and 39.4 per cent. respectively, showing that during these three weeks the weather was exceptionally cloudy. The rainfall record shows that a little more than three times as much rain fell in 1894 as in 1893 during the period from blossoming to the 1st of July, and the total rainfall during the three weeks from May 16 to June 5, 1894, 7.28 inches, nearly equal to the rainfall of the entire months of May and June in 1893. The average temperature for June in 1893 was 71.7° Fahr., while for June, 1894, it was but 62.3, and this notwithstanding the pleasant weather after June 7. It is evident that the weather for three weeks after blossoming time in 1894 was exceptionally cold, dark and rainy, and vegetation could but feel the unfavorable effects of such weather, especially since it was followed by drought.

TABLE XII—SHOWING RAINFALL, SUNSHINE AND TEMPERATURE BY WEEKS AND MONTHS, FROM MAY 19 TO JUNE 30, 1893, AND MAY 3 TO JUNE 30, 1894, INCLUSIVE.

1893.		1894.		Rainfall. Inches.	Sunshine. Average per cent. of possible amount.	Average temperature by standard air thermometer. Degrees Fahr.
May 19 to May 25 .....	.03+	61.9	May 3 to May 9 .....	.37	58.2	61.6
May 26 to June 1 .....	.29	58.9	May 10 to May 16 .....	.04+	61.8	58.2
June 2 to June 8 .....	1.57+	71.4	May 17 to May 23 .....	4.67	2.3	57.2
June 9 to June 15 .....	.....	72.3	May 24 to May 30 .....	2.20+	14.0	53.8
June 16 to June 22 .....	.65	77.5	May 31 to June 6 .....	1.11	39.4	52.9
June 23 to June 30 .....	.86	76.3	June 7 to June 13 .....	.13+	76.5	69.2
			June 14 to June 20 .....	.45+	64.6	74.5
			June 21 to June 30 .....	.43+	68.0	77.5
Total .....	3.40+	68.2	Total .....	9.4	47.5	63.1
May 19 to May 31 .....	.32+	60.1	May 3 to May 31 .....	7.63	37.5	57.4
June 1 to June 30 .....	3.08+	71.7	June 1 to June 30 .....	1.77	64.4	68.8
Total from May 19 to June 30 .....	3.40+	68.2	Total from May 3 to June 30 .....	9.40	47.5	63.1

2. Two treatments with Bordeaux mixture, one being made immediately before and the other immediately after blossoming, diminish the scab to some extent but are not sufficient to control it.

3. On account of the injury to the fruit of certain varieties it was doubtful whether it paid to treat them the second time after blossoming.

4. If not thoroughly done the treatment will be unsatisfactory. In one instance where two men were spraying side by side the difference in the work could be seen for many days or even for weeks afterward. One did the work well, the other did not. Where the work was not well done the scab fungus was more abundant and did correspondingly greater injury. This did not occur in the experimental plot.

The season of 1894 was so unfavorable for securing the best results from spraying for the prevention of pear scab that any treatment which succeeded in controlling the disease in such a season may reasonably be expected to succeed in more favorable seasons. It is safe to conclude concerning pears like the Seckel, which are subject to the scab, that for all practical purposes the best results may be secured by three thorough treatments with Bordeaux mixture,<sup>15</sup> of the 1 to 11 formula,<sup>16</sup> given as follows:

**First Treatment.** After fruit buds break, but before blossoming. See figures 1 and 2, Plate II.

**Second Treatment.** Immediately after blossoming. See figure 3, Plate II.

**Third Treatment.** From 10 to 14 days after the second treatment. See figure 4, Plate III.

To prevent injury from codlin moth Paris green or London purple at the rate of one ounce to 11 gallons of the mixture may be used with the second and third treatments. If the trees are infested with the eye-spotted bud moth use the arsenical poison with the first treatment also. Generally speaking, it is best to use either Paris green or the London purple with all three treatments.

#### TREATING APPLE ORCHARDS FOR SCAB.\*

Since this report will reach many orchardists who are interested equally as much or more in the treatment of apples as they are in the treatment of pears it is well to state that the treatment

\* *Fusicladium dendriticum* (Wallr.) Fckl.

<sup>15</sup> Full directions for making and applying this mixture may be found in Bulletin 74 of this Station and also in another portion of this Report.

<sup>16</sup> See note, page (649).

above outlined has proved equally successful in preventing apple scab and codlin moth in the Station orchards, and this treatment is, therefore, advocated for apples as well as pears with the exception presently to be set forth in the discussion of injury to the fruit from spraying. The treatments should be made as follows:

**First treatment.** After the leaf buds break but before the blossoms open. In this locality this period usually lasts about ten days.

**Second treatment.** Immediately after blossoming.

**Third treatment.** From ten to fourteen days after the second treatment.

One of the Station apple orchards which was given three treatments, the first before the blossoms opened, using Bordeaux mixture alone, the second immediately after the blossoms fell, using Bordeaux mixture and London purple, and a third after an interval of about two weeks, using the same formula as for the second, resulted in excellent success. Although some varieties showed some injury to the foliage the orchard as a whole, on account of its healthy foliage and holding its fruit till it ripened, presented a marked contrast to the orchards of the vicinity which were not treated for scab. A considerable portion of the foliage of the latter turned yellow and dropped during the latter part of June and in July, and much of the fruit dropped also. Since the sprayed trees held their leaves and fruit through this period, it is reasonable to attribute to the action of parasitic fungi under weather conditions unfavorable to the health of the foliage much of the dropping of fruit and foliage from trees not treated with the Bordeaux mixture.

#### INJURIOUS EFFECTS OF BORDEAUX MIXTURE.

The third point proposed for investigation in 1894, as stated on a previous page, was "To what extent is the Bordeaux mixture treatment liable to cause a roughness or russetting of the fruit?" In the report of the experiments with pears for 1893 it was stated<sup>17</sup> that this trouble was not noticed on any of the fruit sprayed that season, and attention was called to the injury of pears by the Bordeaux mixture as noted by Greene.<sup>18</sup> In bulletin 48 just cited he states that he had observed a roughness of the skin of late-sprayed fruit, and cautions against the use of Bordeaux mixture

<sup>17</sup> Bulletin 67 of this Station, page 193, and Annual Report for 1893, page 704.

<sup>18</sup> Green, W. J. Bulletin 48, Ohio Experiment Station, 1893, page 12; Proceedings Western N. Y. Horticultural Society, 1894, page 65.

on pears as follows: "Do not use Bordeaux mixture more than once after blooming on early pears, and not more than twice on late pears."

Galloway<sup>19</sup> observed injury to pears from use of Bordeaux mixture in 1892, but discovered that air-slaked lime being used in insufficient quantities in preparing the mixture resulted in the injury observed.

### The Potassium Ferrocyanide Test.

Jones<sup>20</sup> reports in the *Garden and Forest* injury to both apples and pears in 1894, which he attributed to an application of Bordeaux mixture just after the blossoms fell, the preparation of which was governed by the potassium ferrocyanide test. He expresses the opinion that this method of preparation should be more thoroughly tested before being recommended for general use in orchards. Replying to an inquiry on this subject Professor Jones writes that at the period of the application referred to and about two weeks thereafter there was a considerable rainfall and continued cool, cloudy weather. In the letter referred to Prof. Jones says: "Our weather was cold and rainy also, as you may see from the following summary:

DATES OF SPRAYING.	CONDITIONS AT TIME OF AND FOLLOWING THE APPLICATIONS.		
	Sky.	Rainfall.	Temperature.
First application, before leaf-buds opened, April 23, Bordeaux mixture.	Generally clear.	Only trace during next 10 days.	Rather warm for time of year. May 1 was warmest day of the month.
Second application, after leaves opened and before blossoms fell, May 4, Bordeaux mixture and Paris green.	Cloudy for two days, then clear till May 17.	.85 inch fell May 5 to 7. No more rain till May 18; .38 inch fell May 18 to 19.	Cool for May.
Third application, just as last petals were falling, May 21, Bordeaux mixture and Paris green.	Cloudy May 17 to 20, clear 21 to 22, cloudy 23 to June 3.	.77 inch fell May 23 to 25; 1.41 inch fell May 28 to 31.	Cool for May, especially the last 10 days. May 30 the coldest day of the month.
Fourth application, June 1 to 2, Bordeaux mixture and Paris green.	June 4 and 7 clear. All other days from June 1 to 8 cloudy or partly cloudy. Clear most of next two weeks.	.63 inch fell June 1 to 5. Almost no rain fell during the rest of June except one heavy shower June 27.	Cool until about June 8, when it began to warm into regular June weather.
Fifth application, June 16, Bordeaux mixture.	.....	July was also a very dry month.	.....

<sup>19</sup> Galloway, B. T. Bulletin 3, Division Vegetable Pathology, U. S. Department of Agriculture, 1892, pages 39 and 40.

<sup>20</sup> Jones, L. R. Ferrocyanide Test for Bordeaux Mixture, *Garden and Forest*, volume VII, 1894, page 497.

Injury to pears followed third application. When I visited the orchard again, June 1, it was very apparent on sides of young fruit, and especially on stems, and many had already fallen. Apples were still covered with down of hairs, hence injury would not have been so apparent if present, but I looked for it carefully and could see little evidence of it, so do not think it had occurred so seriously as yet. One Fameuse tree was left unsprayed May 21. It was sprayed as the others before this and also twice afterward (June 1 and on June 15). All the other Fameuse were rusted quite badly, this one practically free from the injury. In age of tree, soil condition, exposure, etc., it was situated no differently from several surrounding it which showed the injury.

There were the two new conditions in my work this year:

1. The mixture was made with the ferrocyanide test.

2. The climatic conditions already noted which were entirely different than we usually have.

In former seasons I have sprayed fruit, both pears and apples at about the same period in their development as I did this season and have seen no serious results. I do not feel that the injury was primarily due to the stage of the development of the fruit, therefore, although its tender condition may partly account for it. In my opinion the trouble lies between the ferrocyanide mixture and the weather. I hope that it may prove to be the latter for the ferrocyanide test is very convenient. I stated in my article in *Garden and Forest* that I have tested the Bordeaux mixture made by the ferrocyanide test on potatoes and find it safe there."

So far as I have noticed the most serious injury to pears in connection with the use of Bordeaux mixture that has been reported is that mentioned by Lodeman<sup>21</sup> as occurring in 1894 in western New York, where, in one instance, 75 per cent. of the crop was ruined as a result, it was thought, of spraying with this mixture. Further inquiry has developed the fact that Paris green was used with the Bordeaux mixture in this case, thus introducing another element of uncertainty as to the cause or causes of the injury, and leaving room for doubting whether this injury should be attributed to the use of the ferrocyanide test.

It is well known that injury follows the use of Bordeaux mixture when prepared with an insufficient amount of lime. An instance of this kind reported by Galloway is mentioned on a previous page. But this need not occur if directions for using the potassium ferrocyanide test are carefully followed, that is to say, if lime is added until when thoroughly stirred the mixture does not change the color of the potassium ferrocyanide when tested. It is our custom after the test shows no color reaction to add a little more lime to insure an excess of this ingredient, and we recommend this practice inasmuch as there need be no fear of injurious results from adding too much lime.

One gentleman who reported to the writer a case where serious injury followed the use of Bordeaux mixture prepared by means

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<sup>21</sup> Lodeman, E. G. Bordeaux mixture and the potassium ferrocyanide test, *Garden and Forest*, vol. VII, 1894, page 455.

of the ferrocyanide test admitted that he stopped adding lime while the test still showed a slight change in color. He did not realize the importance of adding lime until the ferrocyanide would not change color when dropped into the mixture. This incident shows how important it is in recommending the ferrocyanide test to impress on the minds of those who are to use it the necessity of carefully following instructions as to the proper method of its use, and while an excess of lime is not injurious a mixture containing too little lime will surely work injury. But because some people have failed to use this test rightly is certainly no argument against its reliability when rightly used. The use of the test offers a most convenient method of preparing the Bordeaux mixture, and it is also reliable, as many experiments have shown. As stated by Dr. Van Slyke, before the Western New York Horticultural Society, January 23, 1895,<sup>22</sup> by means of this test one part of copper may be detected in about 400,000 parts of solution, certainly a very delicate test. It would be well as before stated, whenever employing this test in the preparation of the Bordeaux mixture, to add more lime after the test shows no further change of color and thus insure an excess of lime.

#### Iodine and Starch Paste Test.

In the address above referred to Dr. Van Slyke described a test even more delicate than the ferrocyanide test which may be conveniently used in preparing the Bordeaux mixture. While that detects one part of copper in 400,000 parts of solution, this one shows one part of copper in five hundred thousand parts of solution. It is used as follows:—Some of the solution to be tested is taken in a white china teacup and to this is added a few drops of ordinary starch paste and then a few drops of a solution of potassium iodide. If any copper sulphate is in the solution, it will act upon the potassium iodide, setting free the iodine, which will color the starch blue. The color is more readily seen against a white background, such as a china cup offers. The starch paste is such as is used in starching clothes.

The solution of potassium iodide may be prepared by dissolving one ounce of the compound in a quarter of a pint of water.

<sup>22</sup> Proc. West. N. Y. Hort. Soc'y, 1895, pp. 108-109.

### Potassium Xanthate Test.

A still more delicate test mentioned in the address above referred to, is obtained by using *potassium xanthate*. Add a few drops of this compound to a solution supposed to contain copper, and if copper is present, there will be produced a yellow color. The color can be seen to best advantage against a white background. This test is capable of detecting one part of copper in 800,000 parts of solution.

### Pears Injured by Spraying.

In connection with the experiments conducted by the Station in 1894, as reported on previous pages, injury to both foliage and fruit sprayed with Bordeaux mixture, was observed in many instances. When the treated trees were compared with the untreated the advantage of spraying was plainly seen, but from Mr. Smith's treatment of trees outside the experimental block it appeared doubtful, in some instances, whether sufficient benefit was derived from the second treatment after blossoming to counter-balance the injury from the treatment. In some cases, after giving two treatments, one before and one after blossoming, it would have been better to take the risk of further injury from the scab instead of giving another spraying. On some trees sprayed only once, and that before blossoming, slight injury was apparent, but increased injury was seen where the trees were sprayed both before and after blossoming. In the former instance the treatment was about May 4, in the later instance the treatments were made about May 4 and May 15. The rainy period began May 16, and the injury was not observed till after it had been raining about 10 days.

The injurious effect as it appeared on the Seckels at the time of fruit harvest was apparent in three ways. (1) The fruit was evidently somewhat smaller in size than the average fruit on adjacent unsprayed trees. (2) The fruit was less brilliant in color than was the fruit on adjacent unsprayed trees. (3) The fruit, though not at all distorted as a result of the spray, was rougher to the touch than was the fruit on adjacent unsprayed trees. With some other varieties of pears and with some varieties of apples, which will be mentioned later, the fruit was distorted on account of injury from spraying. When perfect specimens of Seckels were

found on unsprayed trees they were clearly superior in average size and appearance to the specimens of the best sprayed Seckels, but the very great increase in the amount of marketable fruit of sprayed as compared with unsprayed trees clearly demonstrated the very great value of the treatment even in an unfavorable season, and this notwithstanding the fact that the fruit was injured to some extent by the spray.

The injury from the spray first attracted attention the last of May, when the fruit was little larger than peas. It had then been raining every day for nearly two weeks, and it continued to rain for more than a week longer. As before stated, it rained every day for a period of 21 days from May 16 to June 5, and the weather was unusually cloudy and cool for this period of the year. Before the close of the extremely long period of rainy weather both the foliage and the fruit of many trees that had been sprayed were spotted quite badly. The spots varied from the size of a pin point to a sixteenth of an inch or more in diameter, but frequently were clustered together or coalesced so as to form comparatively large areas on the surface of the fruit. The appearance of the spots at first was that of dark discolorations or pimples on the surface affecting only the superficial layers of the epidermis. These spots or pimples could easily be scraped off with the finger nail, leaving a portion of the green skin of the fruit beneath. Microscopic examination of the fruit showed that the injury usually extended to a depth of four or five cells from the surface. This was afterward followed by a corky scar. In this they differed from the scab spot which affected the tissue to a greater depth.

On trees where injury to foliage and fruit was observed not all surfaces hit by the spray showed injury, for a great deal of foliage and fruit was found uninjured although heavily covered with the Bordeaux mixture. The trouble was more noticeable on the fruit than on the leaves. Some varieties were injured quite seriously, while others were hurt but slightly or not at all, great differences being observed between the varieties in this respect.

At first it was thought that the injury might be due to the Paris green or London purple used as an insecticide in combination with the Bordeaux mixture, but this position soon proved untenable, for Mr. Smith used nothing but Bordeaux mixture in

spraying the portion of the orchard outside the experimental plot, and the injury from spraying was apparent here as elsewhere. Apple trees at the Station sprayed only with London purple, 1 pound to 180 gallons of water, to which lime was added for the purpose of preventing injury, showed considerable injury to the foliage of several varieties as a result of the spray. In other orchards injury to the foliage was also observed where the trees had been sprayed with the arsenites. These observations showed that spraying with either London purple or Paris green alone caused injury, as did also spraying with Bordeaux mixture alone.

Unsprayed trees at this period did not show the characteristic injuries described above, although some discolored spots could occasionally be found, evidently due to various causes, such as abrasions, insect punctures and other unknown sources of injury. The same difference between sprayed and unsprayed trees was noticed about the 1st of June in visiting other orchards in western New York, including those of Messrs. Ellwanger & Barry, Rochester, N. Y. These gentlemen were disposed at first to attribute the trouble to spraying, but afterward decided, as stated in the letter published below, that the injury was due to the weather:

ROCHESTER, N. Y., *December 15, 1894.*

Dr. PETER COLLIER, *Geneva, N. Y.:*

DEAR SIR.—Replying to yours of the 13th inst., we thought last June that the russety appearance on our pears was due to injury from spraying, but on further investigation we discovered that the fruit which had not been sprayed at all was covered also with russet.

We considered the matter at the time and came to the conclusion that the unusual russet color was due to the peculiar season.

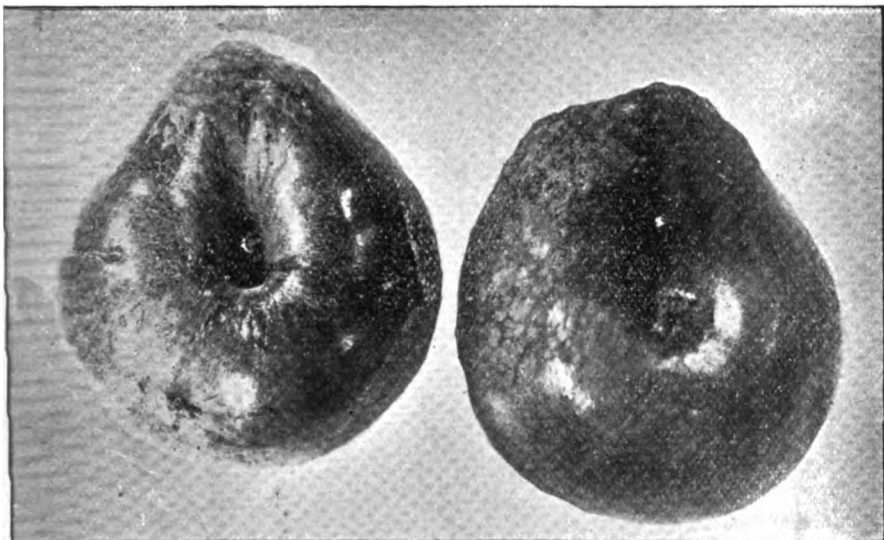
I noticed on my way to the Nurserymen's Convention at Niagara Falls pear trees loaded with fruit having that russet and pink color, in various orchards between Rochester and Niagara Falls, where they could not have sprayed at all.

The remark was so general about the peculiar color of pears this year that we hardly think that it can be attributed to spraying, at least this is our opinion.

We used the Bordeaux mixture tested with the potassium ferrocyanide test.

Yours truly,

ELLWANGER & BARRY.



**FIG. 7.— Ben Davis injured by spraying with Bordeaux Mixture.**



**FIG. 8.— Monmouth slightly injured by spraying.**  
**PLATE IV.— Showing injury from spraying in a wet season.**



In the orchards which came under our personal observation giving opportunity for comparing the sprayed with the unsprayed trees throughout the season the conclusion was irresistible that in many instances the spray injured both foliage and fruit. Figure 7 is reproduced from a Ben Davis injured by spray and figure 8 from a Monmouth injured from the same cause. The injury to the Seckel pears was so slight that it could hardly be shown in an illustration except possibly by a colored plate.

Messrs. Ellwanger & Barry are not the only fruit-growers of western New York, who attribute to the weather the injury to the fruit in 1894. Such injury was seen to some extent in unsprayed orchards in this vicinity, but judging from the reports from counties to the westward of Geneva it was much more marked there than here. It appears, therefore, that here at Geneva the irritation of the spray was sufficient under existing conditions to cause a russetting of the fruit such as in western counties of the State developed as a result of climatic conditions without such irritation from spraying.

#### LIST OF PEARS INJURED BY SPRAYING.

The degree of injury from spray as noted on pears in the Station's orchards was as follows:

1. **Very bad.** Jones. Development of fruit seriously checked.
2. **Bad.** Ansault, Comice, Doctor Reder, Maurice Desportes and Raymond de Montlaur.
3. **Considerable.** Angoulême, Clairgeau, Congress, Delices de Louvenjal, Eastern Beurre, Fondante d'Automne, Frederic Clapp, Gansel's Seckel, Goodale, Lawrence, Madam Treyve, Theresa Appert and White Doyenne; also Anjou in Smith's orchard.
4. **Slight.** Bartlett, Kieffer.
5. **Very slight.** Le Conte.

Some varieties naturally show russetting of the skin of the fruit varying in amount in different seasons. In such instances it was quite difficult to say just how much, if any, injury was done to them by the spray. Among the varieties of this kind may be mentioned Bosc, Boussock, Buffum, Lamartine and Madam Millet.

The mixture was prepared according to the plan used the previous season. The copper sulphate was weighed, dissolved in water and poured into the barrel. The barrel was then filled two-thirds full with water, and lime was added in the form of thin whitewash until the potassium ferrocyanide test showed that a sufficient amount had been used. More lime was then added to make sure that there should be no lack of that ingredient.

The lime was slacked in a barrel half buried in the ground and covered with water to keep it in the condition commonly known as "lime paste;" that is to say, chiefly in the form of calcium hydrate. No doubt some of the carbonate was gradually formed when the lime was kept in this condition, so that some calcium carbonate, in all probability, was added each time the mixture was prepared. The Bordeaux mixture formed in this way would, therefore, probably contain (1) a small amount of copper sulphate in solution; (2) basic copper sulphate; (3) double basic sulphate of copper and lime, and (4) copper hydroxide,<sup>23</sup> the last named greatly predominating.

The small amount of copper sulphate in solution that may exist in Bordeaux mixture can not be considered sufficient to account for the injury resulting from the spray. Granting that the basic compounds referred to are more apt to injure the foliage than is the hydroxide, which, so far as I know, has not yet been proved, there would still be no reason to anticipate trouble from this cause, since chemists hold that in the presence of an excess of the calcium hydrate but very slight amounts of any copper compound, except the hydroxide would be formed in the Bordeaux mixture.

The copper compound or compounds which give the Bordeaux mixture its valuable fungicidal properties are soluble to a slight extent in water. Should the ordinary dew or rain water, as it occurs on the surface of the leaves and fruit, contain a slight amount of carbonic acid, which might be derived either from the atmosphere or liberated during the process of respiration by the plants, it would have greater solvent action than pure water.<sup>24</sup>

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<sup>23</sup> Fairchild, D. G. Bordeaux mixture as a fungicide, Bulletin 6, U. S. Division Vegetable Pathology, 1894, pp. 13-15.

<sup>24</sup> The behavior of some vegetable substances toward copper and some of its compounds. By E. Formento, *Staz. sper. agr. ital.* 18, 686-693, cited by *Journal Chemical Society, Abstracts*, vol. LX, p. 491.

The same may be said of the solvent action of the compounds of ammonia which are absorbed to a slight extent from the atmosphere by rain water.

I am not inclined to attribute the general injury to foliage and fruit in 1894 from spraying to the fact that the preparation of the mixture was governed by the potassium ferrocyanide test, since no injury was noticed in the previous year from mixtures prepared according to this method, but rather am I disposed to attribute the trouble to the spraying combined with the unfavorable weather about the time the injury first became apparent. From what has been said above, it appears that an unusual proportion of the copper compounds applied to the fruit and foliage in spraying might be dissolved in the frequent rains. For 21 days it rained every day — the weather during the most of that period being cloudy and cold when not rainy. The long-continued cloudy weather and the abundant supply of water to the roots of the trees, occurring at a period of very active growth when the first leaves were developing, naturally would tend to produce a tender condition of the leaves and fruit. It seems quite probable that in this condition of the leaves and fruit, and in the continued solvent action of the rain on the particles of Bordeaux mixture adhering to the sprayed leaves, we find the explanation for the unusual injurious effects which accompanied the use of Bordeaux mixture in 1894.

### **Injury to Apples from Bordeaux Mixture.**

One of the first reported instances of injury to apples, from the use of Bordeaux mixture, which has come under my observation is that mentioned by Weed,<sup>25</sup> in 1890, who states that experiments have shown that it is not safe to use Bordeaux mixture against apple scab, since it injures the apples. Neither the strength nor the manner of making the mixture is given in this instance. Green,<sup>26</sup> referring to the statement just quoted, says that the reported injury followed the use of strong Bordeaux mixture. In Bulletin 48 of the Ohio Experiment Station, 1893, page 10, he cautions against using Bordeaux mixture more than twice after blooming, since, "when applied too late in the season it sometimes causes

<sup>25</sup> Weed, Clarence M., Bulletin 4, vol. III, 1890, Ohio Experiment Station, p. 142

<sup>26</sup> Green, W. J., Bulletin 9, vol. IV, 1891, Ohio Experiment Station, p. 193.

a russet appearance on the fruit." This caution accompanies the recommendation of a dilute mixture formed by using one pound of copper sulphate to make  $12\frac{1}{2}$  gallons of the mixture. The experience of the past season at Geneva, 1894, shows that injury to foliage and fruit may follow early as well as late applications of Bordeaux mixture.

Jones,<sup>27</sup> in 1894, found that strong Bordeaux mixture, 1 to  $2\frac{1}{2}$  formula<sup>28</sup> in some cases seriously injured apple leaves after four applications.

One of the apple orchards at this Station was sprayed in 1894 with Bordeaux mixture before the blossoms opened, beginning April 27; again with Bordeaux mixture and London purple after the blossoms had fallen, beginning May 17; and a third time with Bordeaux mixture and London purple beginning June 9. More than two weeks elapsed after the second treatment was begun before it could be completed, the rain preventing the progress of the work. June 4 it was noticed that the foliage of the sprayed trees was in many cases spotted showing the injurious effects of the spray, but the young fruit was so thickly covered with pubescence that no injurious effects were there apparent. Later in the season many varieties of fruit showed injury quite similar to that described as occurring on the pears, and all gradations were observed from the slightest discoloration of the skin to the serious deformity of the fruit. The degree of injury varied with the different varieties. Some were injured slightly or not at all; others were seriously injured. In a few instances the fruit was hurt in appearance and shape by the spray more than it would have been by the scab. For this reason when a period of excessive rain occurs, with varieties which are named in the following list as injured very badly or badly this season, it would be better to cease spraying entirely after the second treatment because it would be preferable to take the chances of injury to the fruit from the scab rather than to risk injuring the fruit by the spray. When the fruit was gathered the injury in the worst cases appeared as brown corky scars in the places where the skin had been killed by the spray and sometimes large scars prevented the symmetrical expansion or growth of the fruit and warty, one-sided or otherwise misshapen fruit was the result. See Plate IV, figures 7 and 8.

<sup>27</sup> Jones, L. R., Bulletin 28, 1892, Vt. Experiment Station, p. 32.

<sup>28</sup> See note, page 649.

Late in the season before the fruit was gathered notes were taken on the injury to the different varieties by the spray, from which the following classified lists are made.

LIST OF APPLES INJURED BY SPRAYING.

1. **Injury Very bad.** Groskoe Selenka Gruner,\* Gideon No. 2 Red Transparent,\* Reinette de Caux, Repka,\* Rhode's Orange, Romna,\* Saint Peters,\* Wagener, White Pigeon,\* and Yellow Calville.\*

2. **Injury bad.** Belborodskoe,\* Cooper's Market, Count Orloff,\* Czar's Thorn,\* *English Pippin*,\* Fameuse, Golden Russet, Grand Sultan,\* Gravenstein, Hurlbut, Jefferis, Jersey Sweeting, Jonathan, Kalkidouskœ,\* Lady Henniker, Longfield,\* Ohio, Ostrakoff,\* Parry White, Pumpkin Russet, Red Russet, Rhode Island Greening, Rome Beauty, Scott's Winter, Smith's Cider, Sops of Wine, Standard, Switzer,\* Vandever, Walbridge, Washington Royal, Washington Strawberry, Wealthy, Winesap, Workaroe.\*

*Crab apples.* Chicago, Coral, Hyslop, Oblong, Paul's Imperial, *September* of Gideon, Transcendent.

3. **Injury considerable.** Amasia, Amos Jackson, Autumn Streaked,\* Ben Davis, Borsdorf,\* Celestia, Carolina June, Duncan, Everbearing, Flory, Fourth of July, Grand Duke Constantine,\* Golden Sweet, Kittageskee, Landon, Lankford, Late Duchess,\* Monmouth, Mother, Nelson's Sweet, Northwestern Greening, No. 38,\* Peck's Pleasant, Peter, Pound Sweet (red), Princess Louise, Rambo, Small's Admirable, Sutton's Beauty, Talman Sweet, Twenty Ounce, Western Beauty, White Doctor, White Pippin, Yellow Transparent.\*

*Crab apples.* Martha, Whitney No. 20.

4. **Injury slight.** Acuba Leaf Reinette, Alexander,\* Andrew's Winter, Buckingham, Chenango Strawberry, Ewalt, Fallawater, Gideon, Haas, Hartford Rose, Hubbardston, Jewett's Fine Red, Karabowka,\* King of Tompkins County, Lady, Lady Sweet, Maiden Blush, McMahan's White, No. 3 Sweet of Gideon, No. 7 Gideon, Occident, Oldenburg,\* Ontario, Powaukee, Primate, Pumpkin Sweet, Red Astrachan,\* Roxbury Russet, Saint Lawrence, Tetofsky,\* Tufts, William's Favorite, William Prince, Wolf River, York Imperial, Zolotoreff.\*

*Crab apples.* Excelsior, Montreal Beauty.

5. **Injury very slight, or none.** Aunt Ginnie, Dominie, Early Harvest, Fall Wine, Fall Pippin, Farris, Green Newtown Pippin, *Jonathan* of Buler, Keswick, Northern Spy, *No. 228<sup>1</sup> Dept.*,\* Pomme Grise, Rawle's Janet, Red Beitigheimer, Sharp, Stump, Titovka,\* Yellow Bellflower.

It is interesting to note in this connection that a notably larger per cent. of crab apples and Russian apples were remarkably susceptible to injury from the spray than were other varieties. In the preceding lists the Russian apples are marked with an asterisk. Varieties like Wealthy, Gideon, etc., said to be descended in part from crab apples, are included with the ordinary orchard varieties. Classified according to the amount of injury from spray, the number of varieties in each class is shown in the following table :

TABLE XIV — CLASSIFICATION OF APPLES ACCORDING TO INJURY FROM SPRAYING.

Class.	INJURY.	CHINA APPLES.		RUSSIAN APPLES.		OTHER APPLES.	
		No.	Per cent.	No.	Per cent.	No.	Per cent.
1.....	Very bad .....	10	47.6	7	22.6	4	3.8
2.....	Bad .....	7	33.3	10	32.3	25	23.6
3.....	Considerable .....	2	9.5	6	19.3	29	27.3
4.....	Slight .....	2	9.6	6	19.3	31	29.2
5.....	Very slight or none .....	.....	.....	2	6.5	16	16.1

From this table it appears that the Russian apples and the crab apples, as represented by the varieties quoted in the above lists, are generally more susceptible to injury from spray in an unfavorable season in this climate than are the other apples cultivated in this section of the country. In the classes which were injured very badly there are 47.60 per cent. of the crab apples, 22.60 per cent. of the Russian apples and but 3.80 per cent. of other apples, while in the classes which were injured very slightly or not at all, there are none of the crab apples, 6.50 per cent. of the Russian apples and 16.1 per cent. of other apples.

Notwithstanding this apparent general susceptibility of the Russian apples to injury from spraying in an unfavorable season, it should be remembered that some of the most desirable of them such as Alexander, Oldenburg, Red Astrachan, Tetovsky and Titovka were injured slightly or not at all by the spray. The susceptibility to injury from spraying does not appear to correspond with the susceptibility of a variety to attacks of the scab fungus, *Fusicladium*; for example, Early Harvest and Fall Pippin are particularly subject to the scab, while they were injured very slightly or not at all by the spray.

The susceptibility of a variety to injury from the spray in unfavorable seasons ought to be considered in selecting varieties for planting in commercial orchards, for although they may show general immunity from attacks of scab and therefore may not need treatment with Bordeaux mixture, they can hardly escape the attacks of the codlin moth and other injurious insects, so that they will probably need to be sprayed with London purple or Paris green. Spraying with these substances is liable to injure the foliage and fruit of some varieties in an unfavorable season the same as does the Bordeaux mixture, as has been explained on a preceding page.

#### INFLUENCE OF SPRAYING ON NEXT SEASON'S CROP.

In order to gain some data on the third question proposed for investigation at the beginning of this article, namely, "To what extent will the benefits of spraying one season influence the crop of the next season?" Seventeen trees were selected for treatment, eight of which had been sprayed the previous season and

nine had not. The location of these trees with reference to each other is shown by the accompanying plan.

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EXPLANATION OF DIAGRAM.

- \* Seckels sprayed six times 1893.
- 0 Seckels not sprayed in 1893.
- . Trees other than Seckel or vacant places.

In the account of the experiments of 1893<sup>27</sup> it was stated that a severe wind storm in August blew off many bushels of fruit from the trees under experiment. The fruit held to the sprayed trees much better than to the unsprayed, thus showing the injurious effects of the scab fungus on the latter. In fact the sprayed trees were too heavily loaded and the fruit on them should have been thinned. The differences in yield between the sprayed and the unsprayed trees in 1893 was very marked, the yield of the eight sprayed trees being 28½ bushels, while the yield of the corresponding nine unsprayed trees was 11½ bushels.

As stated in the bulletin and report just cited, the difference in the foliage in 1893 of the sprayed and the unsprayed trees was marked. Early in the season the sprayed foliage appeared healthier than the unsprayed, and later in the season this difference became more and more noticeable. In consequence of this it was thought that the sprayed trees went into the winter in better condition than did the unsprayed trees, and that they were better prepared for yielding a good crop in 1894 than were the unsprayed trees. In 1894 the 17 trees selected for the experiment outlined above were all treated alike, being sprayed once before blossoming with Bordeaux mixture (May 3) and twice after blossoming with Bordeaux mixture and Paris green (May 15 and June 5).

The classified yields for 1894 is shown in the following table:

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<sup>27</sup> N. Y. Agr. Exp. Station Bulletin 67, p. 191, and Annual Report, 1893, p. 702.

TABLE XV — SHOWING CLASSIFIED YIELDS FOR 1894 OF TREES SPRAYED AND NOT SPRAYED IN 1893.

Number trees	TREATMENT.	No. 1.		No. 2.		No. 3.		CULLS.		Total bushels.
		Bushels.	Per cent.	Bushels.	Per cent.	Bushels.	Per cent.	Bushels.	Per cent.	
8.....	Sprayed in 1893.....	17	63	7	25.9	1	3.7	2	7.4	27.0
9.....	Not sprayed in 1893...	18	67.9	6	22.7	1.75	6.6	0.75	2.8	26.5

From this it appears that, contrary to the expectations expressed in the report of the previous year, the difference in yield between the two groups of trees in 1894 was slight and the differences in per cent. both of first-class fruit and of culls were in favor of the trees not sprayed in 1893.

It will be remembered that the sprayed trees in 1893 yielded at harvest nearly three times as much fruit as did the unsprayed trees, so that on further reflection it is not amazing that they did not greatly excel the latter in yield in 1894. That they were enabled to excel them in the quantity and nearly equal them in the quality of the yield in 1894 after the heavy crop of 1893 is really strong evidence of the permanent beneficial effect of spraying. The permanent injurious effects of the scab fungus on the unsprayed trees in 1893 was no greater, if as great, as the permanent injurious effects of excessive yield of the sprayed trees even though their foliage was kept in good condition by the spray. If this experiment shows anything, it shows that the beneficial effects of spraying can not be expected to take the place of thinning the fruit to prevent the too great exhaustion of the trees by overbearing. Neither can it take the place of fertilizing the soil where trees are producing heavy crops of fruit. *Even when trees are sprayed*, large annual crops of fruit ought not to be expected unless they are well fed and not permitted to overbear.

### SUMMARY.

1. The least number of treatments of Bordeaux mixture that may be relied on to prevent the scab among varieties susceptible to injury from the scab fungus in pear orchards is three.

2. Three applications will be unsatisfactory unless made thoroughly.

3. Some varieties that are peculiarly susceptible to injury from the pear scab fungus may require a fourth treatment, following the third at an interval of about 10 days.

4. One treatment should be made before blossoming and two after the blossoms fall. See p. 660.

5. Spraying before blossoming may result in slight injury to the fruit of some varieties in unfavorable seasons.

6. Injury from spraying with dilute Bordeaux mixture is not confined to trees sprayed late in the season, *i. e.*, the last of June

in this climate, but appears to result from the spray under unfavorable weather conditions, the period of injury varying to early or late as these conditions vary.

7. Varieties of apples or pears noted on the preceding pages, 671 and 675, as injured badly or very badly by the spray should not be sprayed after a prolonged period of rainy weather. It is then better to risk injury from insects and fungi than to risk injury from the spray.

8. Varieties not referred to in the preceding paragraph if they are subject to injury from codlin moth or scab fungus should be sprayed three times even though the weather conditions have been very unfavorable. Although they may be injured somewhat by the spray the yield of first-class fruit will be very much increased by the treatment.

9. The three treatments which have successfully prevented injury from the scab fungus in pear orchards have been found equally successful in preventing injury from the scab fungus in apple orchards.

10. In selecting varieties of either apples or pears for planting in commercial orchards their susceptibility both to the attacks of the scab fungi and the injury from spraying under unfavorable weather conditions should be carefully considered.

11. It is desirable that a simple expression for denoting the strength of Bordeaux mixture come into general use. An expression is advocated which states first the unit of weight for the copper sulphate and then the measure of the Bordeaux mixture formed with this amount of copper sulphate. See page 649.

12. The *potassium ferrocyanide* test furnishes a very convenient method of preparing Bordeaux mixture without weighing the lime. By its use one part of copper may be detected in about four hundred thousand parts of solution. Its reliability is shown by the many times it has been used without injurious results. The *potassium Iodide and starch paste* test and *potassium xanthate* test are used in a similar manner and are even more delicate tests than the potassium ferrocyanide.

13. In using the potassium ferrocyanide test, or other color tests, for preparation of Bordeaux mixture it is best to add a little more lime after the test shows no further change of color, thus

insuring an excess of the lime which can do no harm. The mixture should always be thoroughly stirred before being tested.

14. While it is true that some have injured the foliage or fruit of their trees by using Bordeaux mixture made by means of the ferrocyanide test where the test was not properly followed this does not prove the test unreliable. Injury from spraying during the past season resulted where the ferrocaynide test was not used as well as where it was used, so that the conclusion that all injury to sprayed apples and pears resulted from relying on the ferrocyanide test cannot be sustained. Whether the injury from spraying when this test was followed was greater or less than where it was not used has not yet been shown and no exactly determined data on the subject have yet been published.

## Raspberry Anthracnose.

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In the spring of 1894 a communication was received from Mr. S. A. Hosmer, of Clifton, New York, in regard to anthracnose on raspberries and kindly offering the Station the remains of his once large plantation to use in experimenting with treatment for the disease.

The plantation at one time consisted of 25 acres and was regarded as producing one of the most paying crops of the farm; but through the ravages of anthracnose the acreage was yearly reduced until now scarcely three acres of badly infested plants remain. Seemingly every cane was diseased, immense scabs and blotches from four to eight inches in length and reaching nearly around the cane were not uncommon. The present plantation, consisting entirely of Gregg, was set out in the spring of 1890; it comprises about three acres of gravelly loam situated on a gentle southern slope. The rows, 50 in number, run north and south.

### PLAN OF THE EXPERIMENT.

Primarily the experiment was undertaken to see if the disease could be successfully combatted; secondarily, different solutions were used for the first treatment, so that a comparison might be made as to their effectiveness in treating the disease.

Knowing that a remedy for any fungus disease must be preventive rather than a cure, and that fungi begin their work very early in the spring, it was planned to give the first treatment before the leaf buds opened; at this time strong solutions could be used as there would be no foliage to be injured; accordingly the rows were treated as follows: The first three with copper sulphate, three pounds to 11 gallons of water; the next three with a saturated solution of iron sulphate in water, while the next three were reserved for checks. This plan was carried on throughout the plantation, except the last two rows, making in all 18 rows treated with the copper sulphate, 15 rows treated with

the iron sulphate and 15 untreated, or check rows; of the last two rows one was treated with a 10 per cent. solution of sulphuric acid in water, the other with 10 per cent. of sulphuric acid added to a saturated solution of iron sulphate. After the first spraying, all treated rows were sprayed alike.

#### DATES OF SPRAYING.

The first spraying was made April 18, just as the leaf buds were beginning to swell. All of the different mixtures were applied on the same day. That evening a heavy rain set in which lasted three days. The second spraying was given May 1. All of the treated rows were sprayed alike from this time on with Bordeaux mixture, using one pound of copper sulphate to 11 gallons of the mixture. At this time leaves were about one-fourth grown.

The next treatment was made May 16. The leaves were nearly full grown, while the largest of the new canes were about eight inches in height. The work of the fungus on the new canes was now noted for the first time; a few of the small characteristic spots were seen on the new shoots where they grew close to a diseased spot on an old cane. Immediately after this spraying was given the severe spring rains set in which lasted intermittently for 21 days.

On May 30 a fourth spraying was given. It was found that the previous spraying had seriously injured both the fruit and foliage.

It was found that by a mistake in the capacity of a measure used in making the Bordeaux mixture for the third spraying, it had been made much stronger than was intended. The injury was probably due to this fact. Raspberries on the Station plats that were given similar treatment throughout the season, except that in no application was the mixture used stronger than one pound of copper sulphate for 11 gallons of the mixture, were not injured by the spray. Raspberry foliage was not found to be particularly liable to injury from Bordeaux mixture at this strength contrary to the experience noted in Bulletin No. 6 of the Ohio Experiment Station, 1891, p. 120. However, as the new canes are the only parts of the plants that need protection, the spray should be directed toward them alone.

A fifth treatment was given on June 21. The difference in the amount of disease on the treated and untreated rows was very noticeable at this time. Nearly every fruiting stem and new cane on the unsprayed plants was attacked by the anthracnose while on the sprayed rows the appearance of the disease was much less noticeable.

After the fruiting season was over the old canes, contrary to the usual practice, were removed and burned, when the last spraying for the season was given on August 9.

The plantation was visited on November 22 and the plants of both the sprayed and unsprayed rows were found to have made a very vigorous growth. The canes in the treated rows were nearly free from disease while those that were not sprayed are still very badly affected.

The same line of treatment will be carried on throughout the season of 1895. The conclusions reached at that time will be published, together with details of the experiment.

## Observations on the Application of Fungicides and Insecticides.

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The practice of spraying has passed beyond that period in its development when it was looked upon as an experiment. Numerous results, obtained by practical men, yearly demonstrate the fact that plant diseases and insect pests can be held in check by its means and that with a great profit to the grower. The unusual weather of the year 1894 brought about conditions that tended to make even the most skeptical look toward spraying for relief. The long continued wet weather of the spring was particularly favorable to the growth of many kinds of fungi. This was followed by the prolonged drouth of the summer which favored the development of countless hordes of insect pests. Where the spraying was well done the results obtained during the past season have given the usual satisfaction.

Since people are generally becoming convinced that it pays to spray, there is a growing demand from all parts of the State for information concerning spraying, and especially in regard to spraying apparatus. To meet this demand the following pages are devoted to a discussion of some of the machinery that is now being offered to the public for use in applying insecticides and fungicides.

Paris green and kerosene emulsion still remain the leading insecticides, and since the introduction of Bordeaux mixture about ten years ago, no fungicide has been found that can be used with equal success in combating such a variety of plant diseases. When first brought into notice Bordeaux mixture was made in the form of a thick paste and applied with a brush; its strength and thickness has gradually been reduced till to-day we have the dilute mixture that is easily applied in the form of a spray.

The use of Bordeaux mixture more than any one thing has caused rapid advancement to be made in the methods of apply-

ing fungicides and insecticides in recent years. The knapsacks, force pumps and power spraying machines, with their nozzles that throw a mist-like spray, form a striking contrast to the brush broom and sprinkling pot of a few years ago. Still further improvements are looked for in the near future, particularly in the way of power machines for truck crops; especially for plants of a low spreading habit, such as potatoes and tomatoes, a device is needed that will pick up the prostrate vines, so that nozzles lowered near to the ground and directed upward will throw the spray up through the vines; in this manner it is thought that the spray will reach every part of the plant, which it can not do with the present appliances when the plants are large.

For poisoning worms that feed on cabbage no liquid has as yet been found that gives satisfaction. The surface of cabbage leaves is such that the spray will not stick to them, but collects in drops and falls to the ground. The old-fashioned method of applying Paris green mixed with flour or plaster, with hand sifters, when well done is very effective. Whether any of the machines used for this purpose will do the same work as thoroughly and as cheaply is as yet a question.

For small areas of vegetables and small fruits, for small vineyards, and for vineyards located on hillsides where power machines can not be used, the knapsack sprayer is indispensable; for larger fields, vineyards and orchards a hand force pump mounted on a barrel and fitted with the necessary hose and nozzles, answers the purpose admirably; but for the extensive grower of potatoes and truck crops and for the larger vineyards some form of a power sprayer is more economical.

In making a selection of a power sprayer one must be governed by the kind and extent of the crops to be sprayed and the kind of land on which they are grown. A machine that will do good work on level land might be useless on hilly land. In some localities the ground remains wet for a number of days after a rain so that it would be impossible to use a heavy machine at a time when a spraying might be most needed. Then, again, in large fields of a light sandy nature the work would probably be too hard for one horse to perform. Each person must decide for himself what machine is best adapted to his needs.

In treating of the various machines for spraying truck crops, only those will be mentioned that have been tried by this Station;

the most of them were kindly furnished for testing by the manufacturers, free of charge. The merits and demerits of each machine will be pointed out as they appear from actual use in the field. A few of the vineyard and orchard spraying machines and apparatus that have come to our notice as having special merit will also be described. It is hoped that the accompanying descriptions and illustrations will help farmers, gardeners and fruit-growers to make a more intelligent selection of a sprayer best adapted to their needs.

#### KNAPSACK SPRAYERS.

Knapsack sprayers (see figure 9), as the name indicates, are machines designed to be carried on the back. These are manufactured by a number of firms; the later patterns differ from

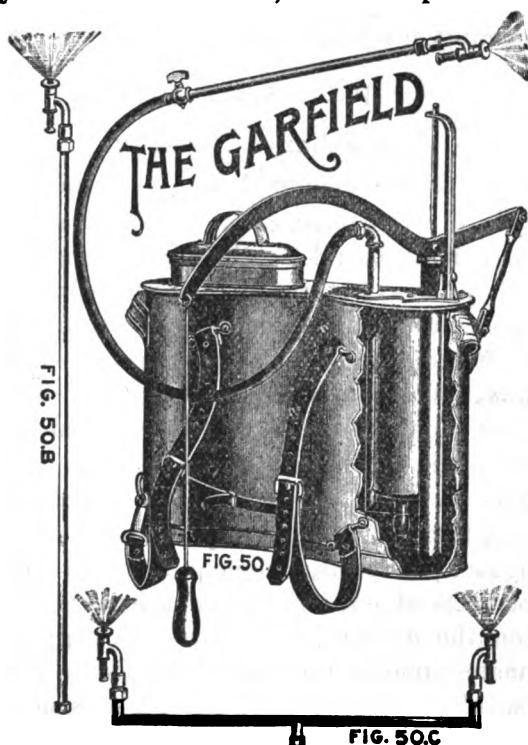


FIG. 9.—The Garfield Knapsack Sprayer.

each other only in small, but occasionally very essential details. In general, knapsacks consist of a copper tank, holding from three to five gallons, being held in place on the back by straps

over the shoulders. They are furnished with force pumps that have a large air chamber, making the discharge constant. In the later patterns the pump handle is so arranged that it can be adjusted to work over either shoulder, so that the pumping may be done by either hand.

In purchasing a knapsack care should be taken to select one in which the discharge pipe enters the tank at the top. If it enters at the bottom it invariably becomes clogged in a short time where heavy mixtures are used, so that it is a constant source of annoyance. If the valves are furnished with rubber balls they should be replaced with marbles when spraying kerosene emulsion, as the kerosene causes the rubber to swell so that it clogs the orifice. When furnished with a Vermorel nozzle the knapsack is a very efficient sprayer. They can be obtained of most dealers in spraying apparatus at a price ranging from \$10 to \$15.

#### POWER SPRAYERS.

##### The Schanck Sprayer.

This machine is manufactured by S. Shangle & Son, of Hightstown, N. J. List price, \$50. For illustration, see fig. 10. It consists of a light barrel, holding 45 gallons, mounted on a one-horse cart. The axle turns with the wheels, and by a cog-wheel arrangement a disk is made to revolve rapidly at the end of a short shaft projecting from the center a short distance back of the machine. The disk is adjustable, as shown in the cut, so it can be raised and lowered as may be required on account of the wind, or to suit the height of the plants. It is made of sheet-iron nine inches in diameter; four narrow strips of the same material, fastened at right angles to its face, divide the disk into eight equal parts, and help to break the liquid into spray. Around its edge is a rim of copper gauze. The liquid is conveyed from the bottom of the barrel through a small hose, which terminates opposite the face of the disk in a nozzle. The nozzle consists of a brass T, punctured with six small holes. The force of gravity causes the liquid to flow out through the nozzle against the rapidly revolving disk, where it is thrown outward by centrifugal force through the gauze in the form of spray. An agitator is made to revolve inside the barrel by means of sprocket wheels attached to the right side of the machine. The

sprayer is easily set in or out of gear from the driver's seat on the barrel by a lever in front, while with a lever behind the barrel the liquid is turned off or on. The wheels are made of iron, strong and durable, but not heavy, and are adjustable, so that the distance between them can be varied to correspond to the distance between the rows. As it is not furnished with a pump there is scarcely any machinery to get out of order, and the time and trouble taken to strain the liquids is done away with as the comparatively large sized holes in the nozzle renders straining unnecessary.

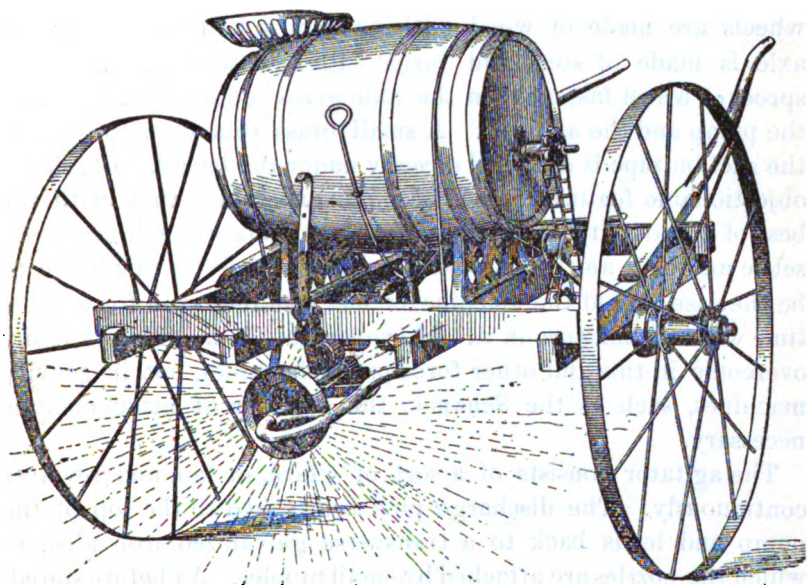


FIG. 10.—The Schanck Sprayer.

The material, however, is not as intelligently applied as when forced out of the improved nozzles. More liquid is wasted and the plants are not as evenly sprayed as when Vermorel nozzles are used. It is better to have the plants well covered with the fine particles of spray than to have them drenched, as disk machines are likely to do. When driving with the wind the driver gets well covered with the spray, even when but a slight breeze is blowing; when the wind comes from either side of the machine the spray is blown over, drenching the rows on the opposite side, while to the windward the outer rows get no spray

at all. Another objection is found in the manner in which the suction pipe is attached, as mentioned in the following paragraph.

The Schanck is a light and durable machine, and does its work as well as any of this style of sprayers that we have seen.

### **The Peppler Sprayer.**

The Peppler sprayer is manufactured by Thomas Peppler, Hightstown, N. J. List price, \$75. For illustration, see fig. 11. This is a light machine, drawn by one horse, and sprays six rows at a time. A 45 gallon barrel is mounted on a cart. The wheels are made of wood, with two and a half inch tires; the axle is made of steel and turns with the wheels. A single sprocket wheel fastened on the axle gives motion by a chain to the pump and the agitator. A small brass rotary pump is used; the suction pipe is attached directly under the barrel, a decidedly objectionable feature; it has been our experience that with the best of agitators the sediment in Bordeaux mixture will gradually settle and clog any pipe so attached; especially is this liable to be the case should the machine be left standing even for a short time with the mixture in it. However, this is a difficulty easily overcome in this and other force-pump machines, but in gravity machines, such as the Schanck, this manner of attachment is necessary.

The agitator consists of a sort of wheel, or fan, and revolves continuously. The discharge pipe is attached to the top of the pump and leads back to a transverse galvanized iron pipe, to which the nozzles are attached by small nipples. As before stated, six rows are sprayed at a time, one nozzle to a row; short joints of pipe are furnished, so that the distance between the nozzles can be adjusted as may be desired to suit rows of different distances apart. By a combination of two elbow-joints the portion of the pipe that projects on either side of the machine can be elevated in passing an obstruction, turning or going from field to field.

By turning off the two sprays directly in the rear and elevating the side pipes to a vertical position, the machine is at once transformed into a vineyard sprayer.

Two leads of hose, intended to be used in spraying fruit trees, are furnished with each machine, but this feature is practical



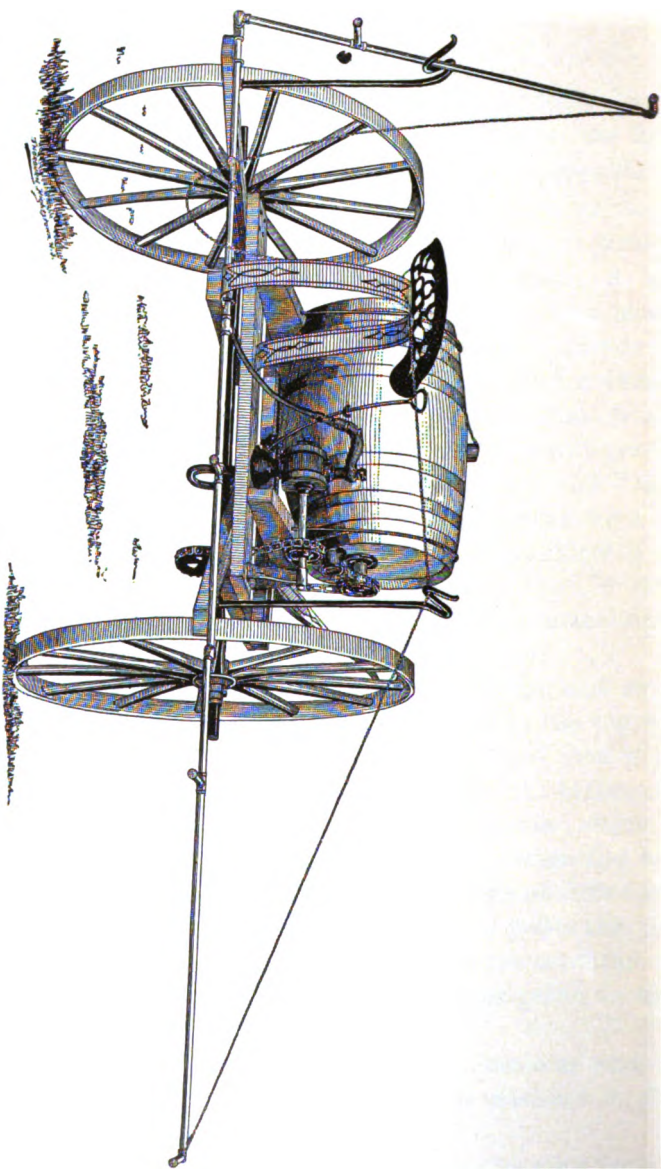


FIG. 11.—The Popple Sprayer.



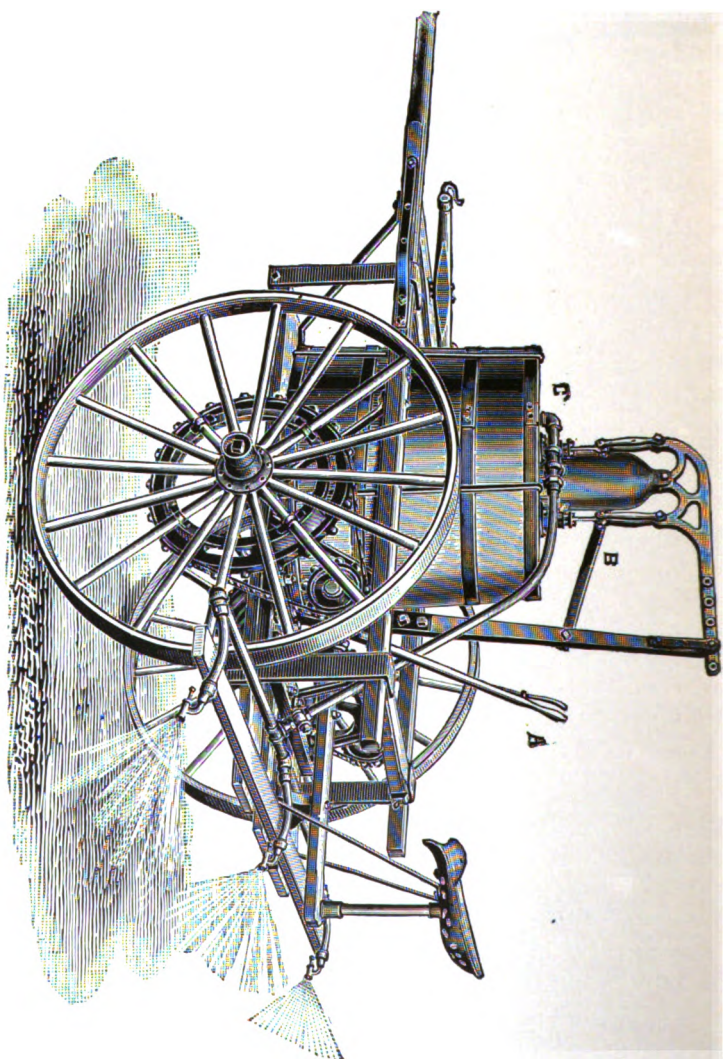


Fig. 12.—The New Victor Potato Sprayer.

only where fruit is grown on a very small scale. The pump is also furnished with a crank so that it may be operated by hand, but the cramped space in which the handle moves makes it very hard work, and consequently this feature is of little value.

This machine has many points of excellence to commend it to the truck gardeners and grape growers; it is light, handy and durable, and has the least machinery to get out of order of any power force-pump sprayer we have seen.

### **The New Victor Potato Sprayer.**

The New Victor Potato Sprayer is manufactured by The Field Force Pump Co., Lockport, N. Y. See fig. 12.

This is a two-horse power machine designed to spray five rows at a time. It is supported by two wheels as in the one-horse sprayers. The wheels are wooden with three-inch tires, and turn on the axle. The power is taken from both wheels by means of large sprocket wheels, clamped to the spokes; these are connected by chains to smaller wheels on the crank shaft which works both pump and agitator. The tank stands upright and holds 70 gallons; the pump, which is placed on top of the tank, is a double cylinder brass pump, with brass valves, strong and powerful. It is furnished with a back pressure safety valve, which prevents undue straining of the hose.

A pump handle is furnished with each sprayer that is easily attached, so that the machine can be worked by hand when required. The suction pipe enters the barrel at the top; the discharge pipe leads back to a transverse pipe to which the nozzles are attached; the transverse pipe is made in sections and a nozzle is attached at each joint, so by using sections of pipe of different lengths the nozzles can be adjusted to spray rows of different distances apart. Ordinary iron gas pipe is used, as it is thought to be cheaper to replace it as it rusts out than to have it made of brass. The nozzles are attached to short lengths of hose so that they are, in a measure, adjustable, as they may rest on the support as shown in the cut, or may be thrust under it and thus get closer to the plants if desired. The part of the support that projects on either side of the machine is furnished with a hinge so as to fold over, while the corresponding part of the pipe is unjointed in passing from field to field.

The agitator, which is one of the important parts of any sprayer, is the weakest point in this machine. It consists of a small blade or paddle on the end of a shaft, suspended from the top of the tank. By means of cog-wheels it is made to revolve half way around, then reverse. This is not sufficient to do the best work. Bordeaux mixture can not be too thoroughly agitated. Another disadvantage is that there is no way of oiling the main wheels except by removing them. In order to do this the endless chain must be taken off, which necessitates the removal of the sprocket wheels on the crank-shaft. Taken altogether, this is quite a laborious task.

From the driver's seat, in the rear, the workings of the machine can easily be watched and controlled.

The pipes can be quickly adjusted so as to form a vineyard sprayer, as shown in figure 13. Four Vermorels are used, two on each side, one above the other and about twenty inches apart, so that on level ground the foliage is nearly all in range of the spray. Double elbow joints are provided, so that the nozzle can be turned at any angle.

When it is desired to spray orchards the pump-handle is easily attached; then, with two leads of hose supplied with bamboo extensions, very good work can be done.

The size of the tank makes this sprayer especially desirable for the extensive potato grower, and in this capacity does the work as well as any potato sprayer now on the market. It is well built, strong and powerful. Furnished with Vermorel nozzles it is listed at \$70.

### **The Columbus Sprayer.**

The Columbus Sprayer, manufactured by W. H. Millspaugh, Branchport, N. Y. List price, \$60. See fig. 14.

This machine is designed for spraying vineyards situated on rough ground, and especially those located on steep hillsides. It is a very compact sprayer, drawn by one horse and requires but a short space in which to turn. The barrel is swung between the wheels by having short pieces of axle, on which the wheels turn, bolted to either side of it. The wheels are low, thus bringing the barrel close to the ground, which prevents the machine from tipping over when working on steep places.

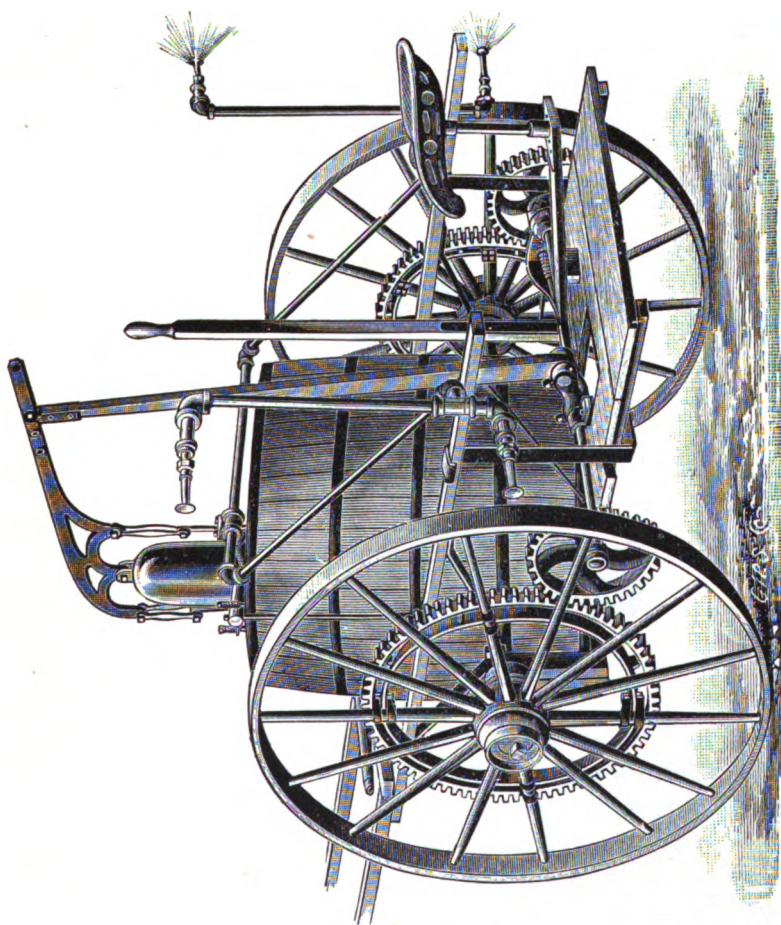


FIG. 13.— The New Victor Vineyard Sprayer.



Swung in this manner the barrel can be tilted while in motion, thus taking the weight off of the horse and preventing waste of material when going down hill. The principal claim of merit by the manufacturer is for the cart and its combination, as any pump can be used. It is furnished with one of the best all bronze, single rotary pumps, placed on a frame-work above the barrel. The power is taken from the left wheel by means of a chain and sprocket wheels. A large air chamber is provided so that quite a pause may be made without stopping the flow of spray. It is furnished with a safety valve which prevents any

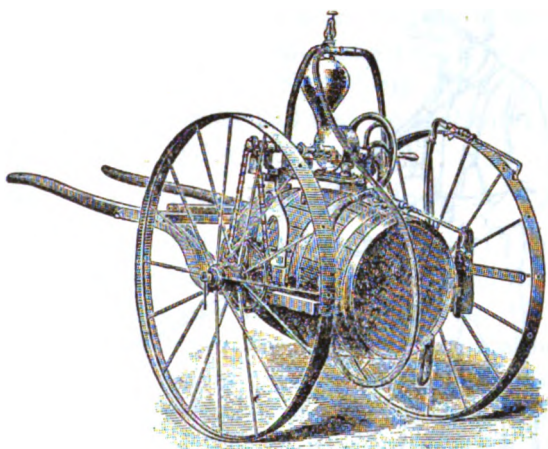


FIG. 14 — The Columbus Sprayer.

strain on the hose when light work is being done. The pump may be operated with a hand crank by throwing the machine out of gear. An attachment for holding the nozzles is supplied when desired, but when spraying on uneven ground the work can not be economically done unless the nozzles are held in the hand and the spray directed where needed. Two leads of hose ten feet long are furnished for this purpose. On the end of each hose is a three-eighths inch brass tube about eighteen inches long; at each end is placed a Vermorel nozzle. With the four nozzles two men will cover a large area of vines in a day.

For spraying vineyards on steep hillsides this is the best power sprayer we have seen.

## POWDER MACHINES.

**The Leggett Powder Gun.**

The Leggett's Paris Green or Dry Powder Gun, manufactured by Leggett & Brother, 301 Pearl street, New York. List price, \$7. See fig. 15. This is a small hand machine for the application of insecticides in the dry form to small fruits and vegetables, such as hellebore to currants, or Paris green to potatoes. It is also useful in the greenhouse in applying tobacco dust and sulphur.



FIG. 15 — The Leggett Powder Gun.

It consists of a reservoir and an inclosed fan operated by a crank, which blows the powder out through a tube. The reservoir holds about a quart of powder; in the bottom of it are three holes through which the powder drops into the tube below. These openings are adjustable, so that the amount to be applied can be regulated as may be desired. It is supplied with a number of nozzles and tubes intended to meet the needs of various conditions. The gun is supported by a strap around the neck and another around the waist. It is made principally of tin; without tubes it is twenty-seven inches long and weighs five

pounds. The even distribution of the powder and the amount of material wasted depends on the skill of the operator.

The manufacturers recommend applying Paris green to potatoes in the pure form; in this manner it is claimed that a pound of the poison will treat an acre. While more material is used than in a spray, it requires less labor to apply. It does the best work when the wind is not blowing, and the powder will stick to the plants better if applied in the morning while the dew is on them. For special purposes the gun is very satisfactory, but for general purposes some form of a spray is better. Most fungicides can not be applied in the dry form, but may be combined with insecticides in the spray; therefore it will be found more economical to invest in a machine that will apply at the same time a remedy for both insects and fungus diseases. Spray will stick to the plants much longer than the powder and may be applied at any time of day regardless of dew and wind.

#### **The Comet Powder Gun.**

The Comet Powder Gun, manufactured by the Comet Manufacturing Company, New Haven, Conn., differs from the Leggett in that the powder is put in a revolving reservoir. The whirling motion throws the powder out of small adjustable openings, where it is caught by the air current from the fan and is blown out of the tube in a continuous stream. This gun is somewhat larger and heavier than the Leggett and of about the same capacity. It does good work and may be used for all purposes for which the Leggett is used.

#### **Spangler's Paris Green and Fertilizer Distributor.**

Spangler's Paris Green and Fertilizer Distributor is manufactured by J. W. Spangler, York, Penn. List price, \$20. See fig. 16. This is a machine that applies Paris green in the dry form, or when desired, it may be used for broadcasting fertilizers.

It consists of two hoppers for holding the poison or fertilizer, mounted on a light steel frame. The wheels are arranged to track each other like a bicycle. Two swinging legs prevent the machine from toppling over when not in motion. It is drawn by one horse and guided by the driver with handles similar to a cultivator. The hoppers may be moved up or down on the framework to suit plants of different heights, and with a lever

the driver can move the hoppers out or in, as may be required, while the machine is in motion. Adjustable slides in the bottom of the hoppers permit the material to fall on rapidly revolving disks, so that it is distributed equally in all directions.

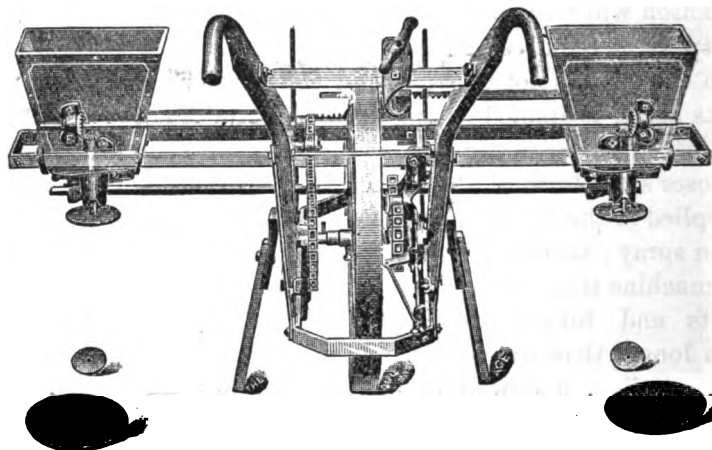


FIG. 16.—The Spangler Paris Green and Fertilizer Distributor.

This machine does fairly good work on still days. When applying poison to plants a funnel-shaped fender is clamped around the disks, thus preventing undue waste of material. Disks of different sizes, as shown at the bottom of the cut, are furnished, so that in applying fertilizers it is claimed to distribute over a space varying from four inches to six or eight feet in width.

#### A HOME-MADE ORCHARD SPRAYER.

One of the best spraying outfits for extensive orchards that we have seen consists of a tank or cask, holding from 150 to 200 gallons placed on a wagon in an upright position as shown in Plate V. (See page 701.) A sprocket wheel clamped to the spokes of one of the rear wheels of the wagon gives motion to the agitator. The hand force pump—in this case a Caswell No. 2—is bolted to the wagon frame in front of the tank. The suction pipe enters the tank from the top, as it should. Two leads of hose are used; at the end of each hose is a metal Y, the ends of which are about 18 inches apart and are furnished with Vermorel nozzles.

When spraying small trees, such as plums and cherries, that have been kept well headed in, one side of one row is sprayed at

a time. The wagon is kept slowly moving; the driver directs the spray from his two nozzles at the lower branches, while a man in the rear standing on a platform is able to reach the upper part of the tree. A third man is required to work the pump. In spraying larger trees it is, of course, necessary to stop at each tree, and the hose should be provided with bamboo extensions.

An outfit like the above is easily and cheaply rigged up and will be found to be more satisfactory for this work than the expensive power machines.

#### PUMPS.

For the ordinary orchardist some form of a hand force pump mounted on a tank or barrel drawn in a wagon serves his purpose best. The pumps for spraying copper compounds should be made of brass or be brass lined, otherwise they soon become corroded. They should have a double discharge, as two leads of hose are usually needed. Many good pumps are on the market, and it would be difficult to say which is best.

For convenience of discussion, pumps that are used in spraying may be divided into suction, displacement, rotary and semi-rotary pumps.

In suction pumps the piston head is commonly packed with commercial packing, which needs to be frequently replaced. As the packing begins to wear, the gritty particles of the spray mixture work into it, causing it to become stiff and harsh. Care should be taken to change it before it gets in this condition. If allowed to remain, the cap must be screwed down tightly to prevent leaking, which causes the pump to work hard, while the gritty plunger cuts the cylinder and soon wears it out. If the valves are rubber balls they should be replaced with marbles when spraying kerosene emulsion, as the kerosene causes the rubber to swell so that the balls can not move. This style of pump does good work when properly taken care of. The piston and valves are hard to get at, and it is a question whether the time necessary to keep them in order will offset the higher price that must be paid for a pump in which this constant attention is not necessary.

In displacement pumps the plunger displaces its own volume of liquid. In the later patterns the valves are on the outside and can be gotten at by simply unscrewing the cap, without taking

the pump apart. These pumps work somewhat harder than the common suction pump. The Caswell, No. 2 (see fig. 17), manufactured by the Caswell Sprayer Co., Sandusky, O., is a type of this style of pumps. It gave good satisfaction at this Station the past year. The pump handle is so arranged that the weight of the body can be thrown on both forward and backward strokes, which makes the labor much easier than when the motion of the arms alone can be used.

Rotary pumps are used principally on power machines. They are very compact and require but little room, and the awkward motion of the crank and crank shaft is done away with. Another great advantage they have over plunger pumps is that they require no packing whatever. When used for hand pumps they are worked with a crank. They are very satisfactory as long as the adjustments fit closely, but the parts soon wear, no matter what they are made of.

A semi-rotary pump consists of a cylinder in which is a closely

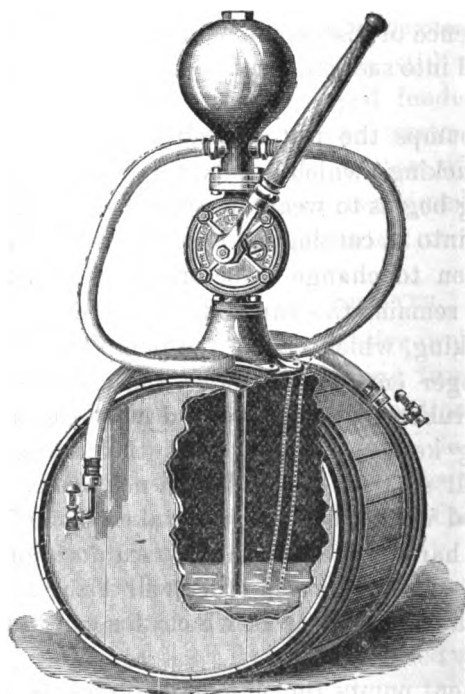
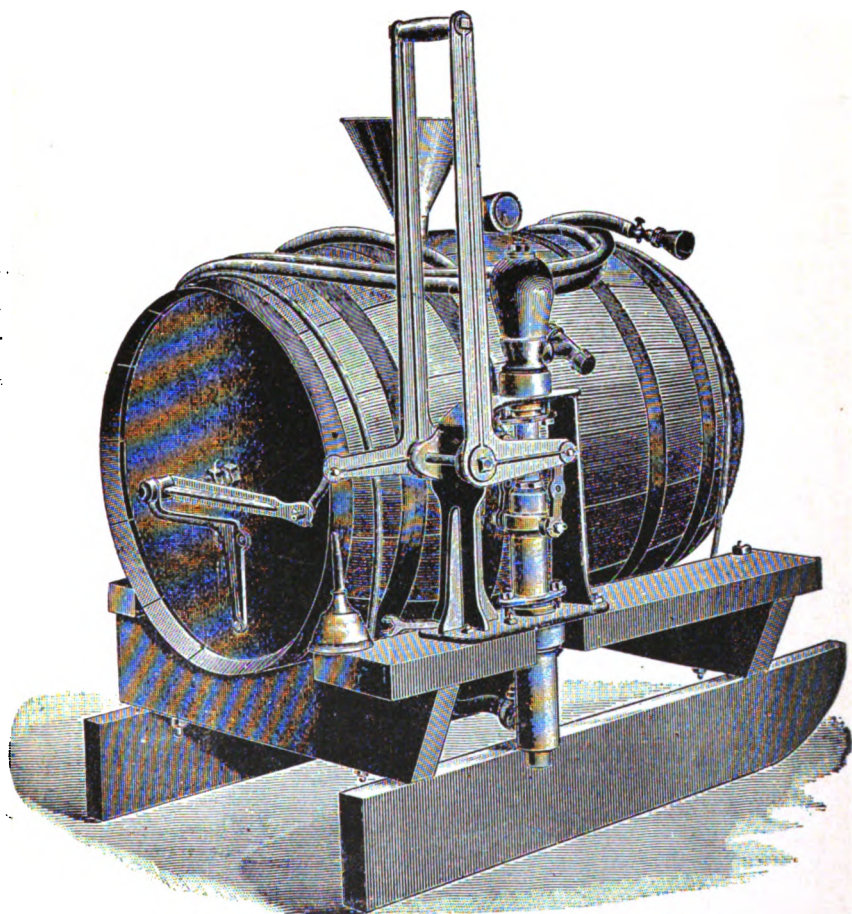


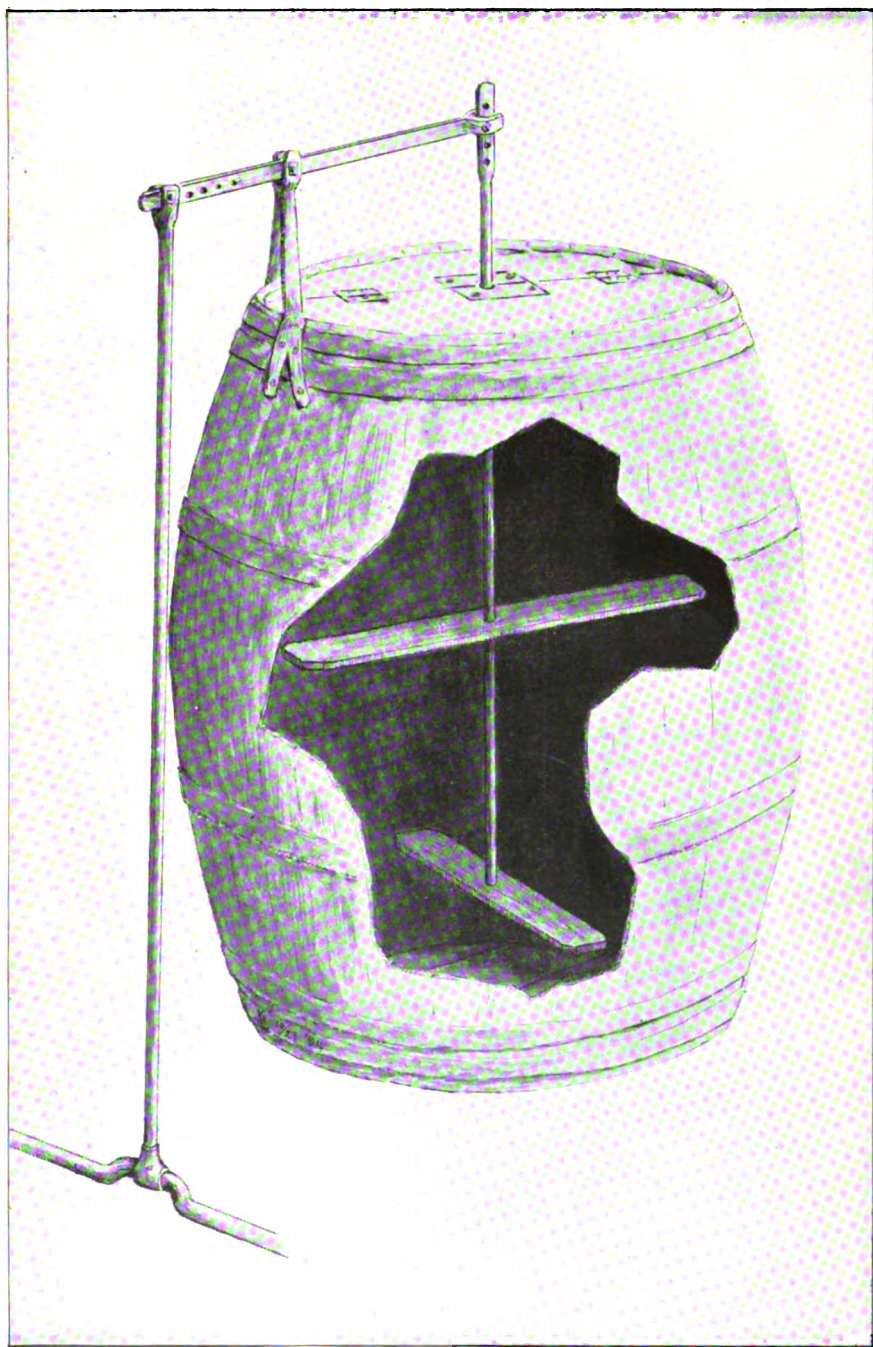
FIG. 18—The Gould Clock Pump.

fitting, double wing, oscillating piston, with a brass valve on each wing. The piston is operated by means of a lever, which may be



**FIG. 7.—The Caswell Pump, No 2.**





**PLATE V.—A Good Kind of Agitator.**



worked from either a horizontal or vertical position. Like the rotary pumps, no packing is used, and they are open to the same objections. They do excellent work, while the adjustments fit closely, but they are soon worn out. When purchasing either a rotary or semi-rotary pump, only those should be selected that are made entirely of brass. In those that are advertised as having brass working parts, the cylinder is made of cast iron, which will soon rust, causing the working parts to wear out rapidly. The "Clock" semi-rotary pump, illustrated in figure 18, manufactured by the Gould's Manufacturing Co., Seneca Falls, N. Y., was used with satisfactory results at this Station during the past season.

#### AGITATORS.

In applying either Bordeaux mixture or Paris green it is very necessary that the liquid be thoroughly stirred in order to insure uniform strength in the application, otherwise the copper compounds and Paris green will settle to the bottom of the tank. Experience has shown that agitating by means of a hose returning a stream to the bottom of the tank is unsatisfactory. A wooden dash or paddle may be usually fitted to the pump something after the manner shown in Plate V, so that with every stroke of the pump it may stir the mixture. When necessary, as for instance after the tank has been standing still for a few minutes this agitator may be supplemented by stirring the mixture thoroughly with a stick.

The agitator is found to be one of the weak points in most power sprayers now on the market. In testing sprayers the past season particular attention was given to the various stirring devices, and in nearly every case they were found to be unsatisfactory. The best agitator that we have seen was a home-made affair, simple in construction, but doing very effectual work. The illustration in Plate V explains itself. The tank is placed in an upright position. A crank-shaft with a fairly long stroke causes an up and down churning motion of the agitator. This is geared so as to run whenever the wagon is in motion, thus keeping the liquid in a constant state of violent agitation.

#### NOZZLES.

In recent years many good nozzles for applying fungicides and insecticides have been devised, but it is generally conceded that,

for the application of Bordeaux mixture, nothing has yet been found that equals the Vermorel. Various forms of this nozzle are on the market, some of which have no joint between the nozzle chamber and the elbow. Occasionally some obstruction lodges between the elbow and the nozzle chamber, and, therefore, it is better to select those forms of the Vermorel which have a joint at this place, so that the part containing the nozzle chamber may be easily separated from the rest of the nozzle and any obstruction removed.

There is great difference in the sprays thrown by Vermorels of different patterns. The size of the orifice, the form of the bevel around it, and whether it is cut on the inside or outside of the cap, seems to have a great influence on the character of the spray. Nozzles that give the widest spread to the spray as soon as it leaves the orifice, throw the finest spray, and are preferable for most kinds of work. Occasionally Vermorels will be found that are not satisfactory. A change of caps will often improve them, and they should not be thrown aside as worthless until this has been tried. These nozzles are not patented, so may be manufactured by any one. The style illustrated in Plate VI has given the best satisfaction at this Station.

The Vermorel nozzle is capable of giving an exceedingly fine spray, which is most desirable, but it can throw the spray but a few feet beyond the nozzle. Its best work is probably done at a distance of from two to four feet from the nozzle's orifice. Some manufacturers have endeavored to make a Vermorel that would throw the spray to a greater distance; in this they have been only partially successful, and always at the expense of the fineness of the spray. It is readily seen that in treating very large trees this nozzle must in some way be lifted into the branches. To meet this want the "bamboo extension" was devised.

#### BAMBOO EXTENSION.

The bamboo extension has been in use for several years in spraying orchards. It consists of a three-eighths inch brass tube inside of a bamboo pole. To the lower end is attached a coupling by means of which it is joined to the discharge hose of the pump. A stop-cock at this end permits the operator to shut off the spray

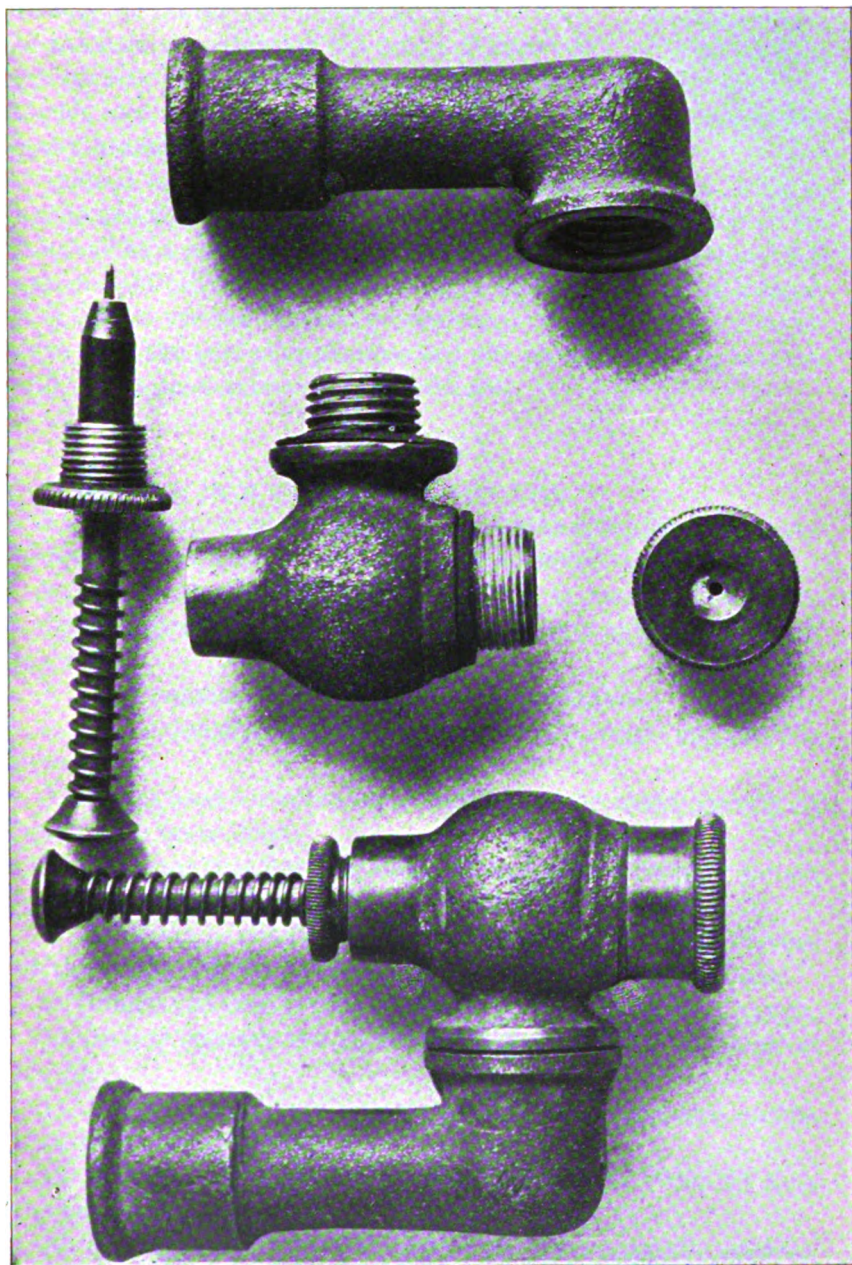


PLATE VI.—The Best Form of Vermorel Nozzle.



readily whenever he chooses to do so. To the other extremity of the bamboo extension the nozzle is attached. The extensions are usually from six to eight feet long so that when the operator stands in a wagon he can with the Vermorel nozzle satisfactorily spray branches from 15 to 20 feet from the ground.

Instead of the bamboo, three-eighths inch gas pipe with a nozzle and the proper couplings may be used, or the hose may be fastened to a pole and thus the nozzle can be lifted up among the branches of tall trees, but where large orchards are to be treated it is best to use the bamboo extensions. Spraying is hard work even with the best of appliances and the use of clumsy apparatus will not be economical in large orchards.

### SUMMARY.

1. Spraying pays when intelligently done.
2. Great improvements have been made in spraying machinery in recent years, but better machines are needed.
3. For potatoes and tomatoes a nozzle is needed that can be lowered between the rows and directed so as to spray up through the vines.
4. The knapsack sprayer is almost indispensable.
5. For extensive growers a sprayer of large capacity is necessary.
6. Pumps used for spraying should either be made entirely of brass or be brass lined.
7. In pumps that have a packed piston-head the packing should be frequently changed.
8. Hand-pumps should be constructed so as to admit of the use of the weight of the body on the handle when working them.
9. Rotary and semi-rotary pumps do good work while in repair.
10. In any sprayer the suction-pipe should enter the tank at the top.
11. Spray is more intelligently applied with Vermorel nozzles than with disk machines.
12. The form of Vermorel nozzle illustrated in Plate VI does the best work.
13. The agitator is one of the most important parts of a sprayer, but as usually made is very unsatisfactory.
14. The best form of agitators work up and down in an upright tank like a churn-dash.

15. Power machines are not practical for spraying orchards.
16. In spraying large trees bamboo extensions should be used.
17. Each person should select a sprayer that is suited to his particular needs.
18. The same sprayer should not be expected to do all kinds of work with equal satisfaction.
19. No liquid has as yet been found that is satisfactory for killing insects that feed on cabbage.
20. Hand Paris green sifters are effective for poisoning worms (larvæ) that feed on cabbage.
21. Poison in the dry form is best to use against some insects. For applying this and for distributing sulphur and tobacco dust in greenhouses the powder guns are useful.

#### BORDEAUX MIXTURE.

Bordeaux mixture is made by dissolving four pounds of pulverized copper sulphate in from half to two-thirds of a barrel of cold water. The necessary amount of fresh slaked lime is then poured into the barrel in the form of a thin whitewash and the whole mixture diluted to 45 gallons. The copper sulphate will dissolve more readily if it is suspended near the upper surface of the water. A basket or coarse sacking may conveniently be used for this purpose. If the solution is wanted at once hot water may be used to dissolve the copper sulphate since it dissolves more quickly in hot water than in cold. It should never be dissolved in iron vessels. This formula is best for general use, but for potatoes the mixture should be stronger, using one pound of copper sulphate to make seven gallons of the mixture.

#### Weighing and Straining the Lime.

When the mixture is used in power spraying machines with stationary nozzles it should be run through a sieve so as to take out all particles that might clog the nozzles. When hand pumps are used straining will not be necessary if care is used, in pouring the lime.

The amount of lime necessary to form the Bordeaux mixture was formerly determined by weighing, using two-thirds as much lime as copper sulphate, but by means of the potassium ferrocyanide test the necessity of weighing the lime is now obviated.

### Potassium Ferrocyanide Test.

Pour the lime into the copper sulphate solution, stir the mixture thoroughly and then add a drop of the potassium ferrocyanide. If enough lime has been added the drop will not change color when it strikes the mixture, otherwise it will immediately change to a dark reddish brown color. More lime must then be added till the potassium ferrocyanide does not change color when dropped into the mixture. A little more lime should be added after this test shows no color, as it sometimes happens if the mixture has not been thoroughly stirred, that some of the copper sulphate in the bottom of the barrel has not yet been precipitated, while at the surface the mixture shows no color when the test is applied; so it occasionally happens that after the mixture has been standing a few minutes the potassium ferrocyanide will again give the dark color, showing that not enough lime had been used.

The potassium ferrocyanide, also known as the yellow prussiate of potash, is a poisonous substance. It is a yellow salt which readily dissolves in water and a solution may conveniently be kept on hand in a small bottle. The commercial form of the potassium ferrocyanide may be used. A few cents should purchase enough to last through the season.

### Excess of Lime.

It is important that enough lime be added, otherwise the mixture may injure the foliage, while an excess of lime will not harm the foliage.

### KEROSENE EMULSION.

Kerosene emulsion is made by dissolving one-half pound of common soap or whale oil soap in one gallon of soft water. Heat the mixture and when boiling hot remove it from near the fire and add it to two gallons of kerosene. The whole is now thoroughly mixed by pumping continuously through a small force pump for about five minutes. Mix until the ingredients form a creamy mass that becomes thick when cool and from which the oil does not separate. When using on foliage dilute with from 10 to 15 parts of water; when used as a winter treatment it may

be applied as strong as one part of the mixture to four parts of water. This emulsion is used to kill insects that have sucking mouth parts; it is not a poison but kills by contact.

When applying the mixture with pumps that have rubber balls for valves, it must not be forgotten to replace the balls with marbles.

#### PARIS GREEN.

Paris green is used to poison insects that have biting mouth parts. It may be applied either in the dry form or in a spray. When the spray is used the Paris green may be combined with Bordeaux mixture, or it may be applied, mixed with water. In either case the same amount of poison is used. For pomaceous fruits one pound of Paris green to 150 or 200 gallons is commonly used. For stone fruits the mixture should be weaker, using one pound of Paris green to 250 or 300 gallons. When used with water, two pounds of fresh slaked lime must be added for each pound of Paris green, to prevent injury to the foliage.

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REPORT  
OF  
ENTOMOLOGICAL WORK.

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VICTOR H. LOWE, ENTOMOLOGIST.

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## PART I.

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I. SOME INSECTS INJURIOUS TO SQUASH, MELON AND CUCUMBER  
VINES.

II. THE ASPARAGUS BEETLE.

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## PART II.

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PRELIMINARY REPORT OF EXPERIMENTS WITH REMEDIES FOR A  
LECANIUM SCALE INFESTING PLUM TREES IN WESTERN NEW  
YORK.



## PART I.

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# INTRODUCTION.

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Squashes, melons and cucumbers are grown to a considerable extent in all sections of the State, especially on Long Island and in the vicinity of New York city, where they form very important crops. The insect enemies of these crops are numerous and destructive, and in recent years especially growers have been seriously embarrassed by them.

Asparagus, also, is a crop of much importance throughout the State, and especially in the localities above mentioned. The asparagus beetle is one of the chief enemies of this vegetable and, although it has been known and dreaded in the southeastern portion of the State for many years past, but comparatively little success has yet attended the many efforts of careful growers in these localities to subdue it.

Owing to the fact that the entomological work on Long Island was undertaken very late in the season (July 23) and because of unavoidable hindrances to its active prosecution, it has not been possible to make a thorough investigation of the work and habits of these insects as they occur on the island. But inasmuch as these insects are not new to science, and because of the demand for a popular report concerning the best preventive methods and remedies for them now known, the following accounts of their life-histories and suggestions as to remedial measures have been collated.

The following pages contain brief accounts of the life-histories and habits of some of the most important insect enemies of the crops above mentioned, together with suggestions and recommendations as to the best methods of controlling these pests. Under the circumstances some of the remarks as to remedial measures can only be suggestive rather than conclusive.

The Station will be glad to hear at any time from those who wish aid or information, and it is especially desired that all insect outbreaks of a serious nature be reported at once, and, when possible, the report accompanied by specimens of the insects and injured plants. When insects are to be sent by mail, they should be put in a strong, securely fastened box. An ordinary baking powder can, the cover of which has been perforated with small holes, makes a good mailing case. Letters and specimens should be addressed to Dr. Peter Collier, Geneva, N. Y.

## I. Some Insects Injurious to Squash, Melon and Cucumber Vines.

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### THE SQUASH-BUG.

(*Anasa tristis*, De Geer.)

The squash-bug is probably very well known to most Long Island farmers, as it has been unusually abundant on all parts of the island for several years past, and especially during the past season. Indeed, it is safe to say that this insect is known to almost every one, for it may be found at any time of the year, either sucking the sap from the vines in the garden or hidden away during the winter months under some board or in the wood pile or beneath almost any rubbish that will afford protection from the cold winter winds. The full grown bug is about five-eighths of an inch long, blackish brown in color above and dull ochre yellow beneath. When roughly handled or suddenly disturbed it emits a disgusting odor, which has given it the rather undignified name of "stink bug."

This insect is an old and well-known pest to growers of squashes and other cucurbits. It is found throughout the United States, and when occurring in large numbers is to be much dreaded. In some localities on Long Island its work is considered at times to be almost as serious as that of the squash-vine borer. Its ravages on the island this past year, especially in the vicinity of Brooklyn, have been unusually severe. In this locality squashes are grown in abundance, forming one of the main crops.

The squash-bug belongs to one of the largest orders of insects, which includes more than 10,000 species found in the United States. To this group belong many of our most serious insect pests, including the plant lice and scale insects. They are known as true bugs, and are designated by the term *Hemiptera*. The *Hemiptera* are partially characterized by the mouth parts being modified so as to form a more or less slender beak by means of

which the tissue of the host is punctured and the liquid on which they feed is sucked from beneath. Fig. 6, Plate I, is a side view of the head and beak of a squash-bug. When at rest the beak is drawn up and lies along the under side of the head and thorax.

Although usually preferring squash vines this insect is not infrequently found attacking melon and pumpkin vines. The bugs puncture the tissue with their stout beaks, inject a drop of poisonous saliva and suck the sap. The poison causes the tissue in the vicinity of the puncture to wilt and finally die, thus causing much more harm than the mere loss of sap. Nearly all parts of the plant are liable to attack. Even the fruit does not escape, and the bugs are frequently found, on young vines especially, attacking the roots just below the surface of the ground.

### Life-History.

Although the life-history and habits of the squash-bug are generally well known a few words on the subjects, both descriptive and otherwise, will not be out of place here. In the fall the bugs leave the vines and seek shelter under any rubbish at hand or between the boards of barns, sheds or other outbuildings. Here they remain during the winter. In the spring the survivors come forth usually about the middle or last of June. The females deposit their eggs usually on the under side of the leaf, but occasionally on the upper surface as well. They are as a rule deposited in groups of from three or four to many times that number, and are securely stuck to the leaf by a gummy substance. The eggs are not very large, being only about .04 of an inch in length. They are dull red in color and to the unaided eye appear smooth and shiny. When viewed from above they are seen to be oblong and slightly flattened on two sides. Fig. 1, Plate I, shows different views of these eggs as they appear when detached from the leaf. In about 10 days the eggs hatch.

The young bugs resemble the parents in general appearance except that their wings are not yet developed. They are also somewhat broader in proportion and the antennæ, which are very dark brown in color, are comparatively large. The thorax and wing scales are dark while the abdomen is of a pale ash color. As they grow older they increase in size, shedding their skins, or molting, from time to time and becoming more oval and of a dull

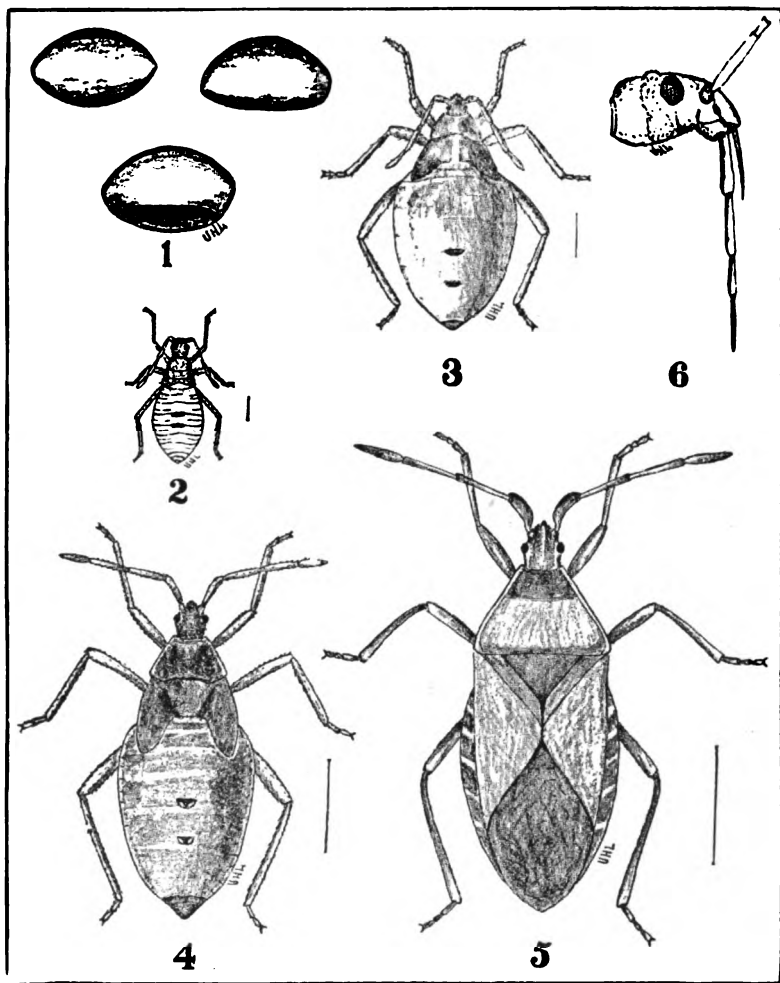


PLATE I.—The Squash Bug.

1.—Eggs; greatly enlarged. 2.—Young bug, after second molt. 3 and 4.—Same, more fully developed. 5—Adult. 6.—Head and beak, side view. Enlarged. (Original.)



ochre yellow beneath. At the time of the last molt the upper surface of the abdomen becomes more or less depressed and the fully-developed wings appear. Plate I shows the squash-bug in different stages of development. It may also be added that squash-bugs feed at night as a rule, coming forth from their hiding places about dusk and remaining on the vines during the night. During the day they usually hide on the under side of the leaves.

Several broods appear during the season. Unhatched eggs were found on squash vines in a field at New Lots, L. I., as late as September 10 and very young bugs the 1st of October.

### Remedies.

"An ounce of prevention is worth a pound of cure" in this case especially, for when squash-bugs once get well started in a field it is almost impossible to get rid of them. Insecticides are as a rule of but little value. Poisons would be of no use as the insect does not bite the tissue but sucks the sap from beneath the surface. There are few odors more offensive than that emitted by this "old timer sinner," and a repellant that would drive a more respectable bug away will have little or no effect upon this one. So far as has been observed, those farmers on Long Island who have succeeded best in combatting this pest are those who do not allow any rubbish to accumulate on or near their squash fields. Clean culture is always embarrassing to the squash-bug.

Several farmers have asked with regard to the value of kerosene emulsion, insect powder, etc., as remedies for the squash-bug.

As before stated, insecticides and repellants are generally considered of but little value in this case. However, the following account of experiments and observations may be of interest:

Early in September a field of squashes in the vicinity of Brooklyn was found to be badly infested by this insect. The patch was a small one and nearly surrounded by a dense growth of weeds and underbrush. A large rubbish pile in the immediate vicinity had evidently furnished shelter for the hibernating bugs during the winter. They had gathered there in great numbers and were found in all stages of development. The bugs had evidently commenced at the east end of the patch near where the rubbish pile lay, and had up to that time totally destroyed

every vine on that half of the field. All that was left to indicate that vines had ever been there were a few withered stalks and occasionally a half-grown, rotting fruit. By the 1st of October, nearly every vine had been destroyed. Along the line of attack which stretched almost straight across the patch from north to south the bugs were so thick one could hardly step on the ground without destroying very many of them. Although great numbers were on the ground in sheltered places and on the undersides of the vines, many were found congregated in groups on the under, and frequently on the upper surface of the leaves; especially those that had begun to wilt. Eggs were found in abundance early in September and young bugs as late as the 1st of October. Plate II is from a photograph taken in this field.

Owing to the great number of insects present and the different stages represented, this field furnished a very good opportunity for testing the effect of bisulphide of carbon upon the pests. Accordingly two fluid ounces of the carbon were poured into a shallow dish and placed near a fallen and withered leaf upon which were numerous squash-bugs of all sizes. A large sheet-iron bucket, which happened to be near at hand, about three feet across the top, was inverted over the whole and the edges forced into the ground to prevent the circulation of air. At the end of half an hour the bucket was removed and about 50 bugs which were nearest the dish were apparently dead. Twenty-five of them, the older ones, revived soon after being exposed to the air. The carbon was only partially evaporated. Subsequent experiments, both in the field and laboratory, showed that a much less amount of carbon is sufficient but that the insects should be exposed to its fumes for a much longer time. The young bugs are much more susceptible than the mature insects. The weather was cool with a stiff breeze blowing. On a warm day the liquid would have evaporated more rapidly and thus been more effective.

The experiment with pyrethrum powder was as follows: A badly-infested portion of the patch was selected and the powder applied *full strength*. A Leggett powder gun was used, and both young and old bugs were thoroughly dusted and, in some cases, completely covered. Although at first somewhat disturbed



PLATE II.—Squash bugs on withered leaf. (From photograph.)

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by the powder, they were quiet again in an hour. The day was warm and bright, with little or no breeze to blow the powder away. Two days later the same spot was visited and, as was expected, the bugs appeared to be undisturbed.

A similar section was sprayed with kerosene emulsion. The emulsion was made by dissolving a bar of hard soap (about three-fourths of a pound\*) in a gallon of boiling water. As soon as the soap was thoroughly dissolved the solution was removed from the fire and, while hot, two gallons of kerosene oil added. The mixture was then violently agitated by pumping through a small force pump back into itself. This was continued for about five minutes, when the mixture assumed a thick creamy consistency. This is called the standard emulsion, and may be diluted at once with cold water or set away in a cool place. It will keep for some time, becoming thick and of the appearance of thick milk. When in this condition it should be heated before being diluted. This standard emulsion was diluted with four parts of water and the mixture applied in a fine spray by means of a knapsack sprayer and Vermorel nozzle. The young bugs succumbed almost immediately, those half grown not until some time later, and the mature bugs were apparently not affected. In half an hour, however, nearly all the insects that the spray had touched were dead. The vines did not appear to be injured until several days later, when they were again visited just after a heavy rain and were found to be much wilted. Another application of the emulsion, diluted with six parts of water, destroyed the young bugs only. And it was found at another time that the emulsion, diluted with nine parts of water, was fatal to young bugs, but seldom affected the adults.

The bisulphide of carbon and kerosene emulsion remedies would hardly be practical, except in certain cases, and the pyrethrum powder not at all. The bisulphide of carbon could be applied in the spring when the young vines are being attacked by the newly hatched insects. Any tight covering sufficiently large to cover the vines should be placed over the hill, and a very little bisulphide in a shallow dish placed under it and allowed to remain for an hour or two. It is hoped that some experiments of this kind may be tried in the spring. Kerosene emulsion applied in a spray

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\* One-half pound of soap to a gallon of water is usually considered sufficient.

would not be likely to injure the vines, if used not stronger than one part of the emulsion to from seven to nine parts of water.

Prof. J. B. Smiths,\* of the New Jersey Agricultural Experiment Station, recommends taking out and destroying the vines just as soon as the crop is off, or better yet, plowing the vines under in the fall, thus destroying every shelter for the bugs. Dr. J. A. Lintner† recommends placing bits of boards, chips, pieces of wood, etc., near the hills to serve as traps. The bugs will crawl under these during the day and may be easily captured and killed. He also suggests that leaves be stripped from the lower part of the vines and spread on the ground beneath. The bugs are particularly fond of the juices of wilted leaves and will accumulate under them in great numbers. These traps should be examined daily and the insects caught and destroyed. This may prove a great deal of work and would certainly be more practical on small fields than on large ones, but it should be borne in mind that insect pests, and especially such pernicious ones as the squash-bug, can not be effectually checked without persistent and systematic effort. In those localities especially where the squash-bugs were numerous this past summer, their appearance should be watched for next spring and the first bugs caught and destroyed. It will not pay to wait until the middle summer before beginning operations; the young vines especially should be carefully examined for eggs which are easily recognized and should be destroyed. These preventive measures in the spring, together with the clearing away of rubbish and plowing in the fall, will do much to check the work of this insect.

From the above we may summarize thus as to remedies:

1. When confined under a tight covering and exposed to bisulphide of carbon, squash-bugs are killed by it. Young bugs, those less than half-grown, are much more susceptible than mature ones.

2. Pyrethrum powder is not practical as a remedy against the squash-bug.

3. Although kerosene emulsion will kill the old bugs if applied at a strength of one pint of the emulsion to four parts of water, it is not a practical remedy except in severe cases, as the

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\* Report of the Ent. Dept. N. J. Agr'l Exp. Sta., 1902, p. 490.

† Eighth Annual Report on the Injurious and Other Insects of the State of New York for the year 1891, p. 206.

emulsion of this strength would endanger the plant. The emulsion may be used with safety, however, at a strength of one part of the emulsion to nine parts of water, and at this strength will kill the young bugs.

4. The squash field should be free from rubbish and should be cleaned up and plowed in the fall.

5. Bits of boards, chips, squash leaves, etc., placed underneath the vines make good traps. They should be examined daily and the bugs destroyed.

6. In the early spring pick the old bugs from the vines and destroy them.

#### THE SQUASH VINE BORER.

(*Mellitia ceto*, Westw.)

Of late years the squash vine borer has become an unusually well-known pest in all parts of the State and especially on Long Island and in the vicinity of New York city. Although not feeding above ground, its presence is plainly indicated by the appearance of the affected vines, which at first turn to a very light shade of green and then suddenly wilt and finally wither and die. As hereafter explained, the adult is but indirectly the cause of this condition of the vines, as the injury is done by the immature form only. In this stage it has proved to be one of the most destructive pests of the past season. Under date of August 9, Mr. William A. Fleet, of Cutchogue, L. I., writes: "The squash vine borer has been very plenty for several years, so much so that I have about given up trying to grow squashes, cucumbers and melons, except very late planted." Mr. Fleet has evidently had much the same experience as many other growers.

In the vicinity of Jamaica and Brooklyn the work of this insect was observed in a number of fields of squashes. As a rule from about one-third to one-half of the vines were found to be more or less affected, and from estimates made by careful growers it is safe to say that nearly if not quite 50 per cent. of the crop of late squashes was destroyed by the work of this pest during the past season. Of the squashes, the borer seems to prefer the Hubbard and marrowfat varieties. Cucumber, melon and pumpkin vines are also liable to attack.

Unlike the squash-bug, this insect does its work of destruction in the larval\* state only. In this case it is a fat, white, grub-like larva, which, when full grown, is about an inch long and has a dark-brown head. Plate III, Fig. 1, represents the larva, and Fig. 2 the head and first segment, showing the peculiar V-shaped marking. The mature insect is not generally well known, as it is seldom seen except in the cool of the day—early morning and just at dusk, when they are somewhat sluggish. When once examined, however, this beautiful insect is not likely to be forgotten. One can hardly realize that such a repulsive looking, clumsy grub could become such a spry, fairy-like moth.

Although the colors are subject to more or less variation, the body is usually tawny brown, with five black spots on the upper side. The fore wings are brown, but have a greenish tinge. In shape they are long and narrow. The hind wings, being devoid of scales, except on the margins and veins, are transparent. They are shorter and broader than the fore wings. Plate III, Fig. 5, shows the mature moth.

This insect belongs to the same order as the butterflies, designated as *Lepidoptera*, and to the same family as the currant stem borer and peach-tree borer. The squash vine borer has long been known in the United States and was first described by Dr. Harris in 1828. It is within more recent years, however, that its work has attracted much attention. In his annual report for 1885, Dr. Lintner published an account of it in response to inquiries and requests from numerous New York farmers. To the unaccustomed eye these insects resemble bees and wasps and are often mistaken for them.

### Life-History.

According to Rev. Mr. Hulst, as quoted by Dr. Lintner †, who was one of the first observers of this insect on the island, "the moth appears shortly after July 1st.‡ During the summer of 1882 I captured some 30 specimens about a small bed of summer squashes in a neighbor's garden. The moths fly during the day,

\* It may be well to note that the term larva is used to designate the first stage after the egg. Larvæ are frequently incorrectly referred to as worms. "Pupa," that stage which immediately follows the larva and "imago" or "adult" as the last stage or mature insect.

† Second Annual Report on the Injurious and Other Insects of the Vine of the State of New York, p. 61.

‡ It is now known that this insect appears on Long Island frequently by the middle of June.

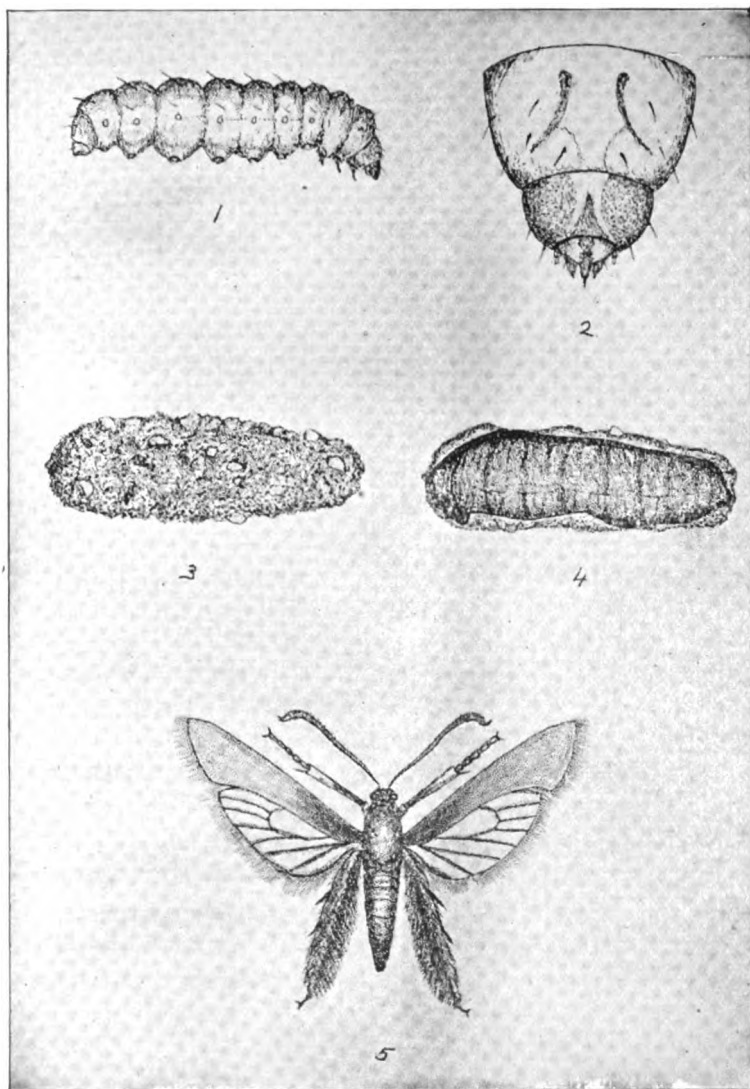


PLATE III — The Squash Vine Borer.

Fig. 1—Larva. 2.—Head and first segment\*, showing V-shaped marking. 3.—Cocoon in which larva passes the winter. 4.—Same cut open, showing larva. All enlarged about one-half, with the exception of fig. 3, which is greatly enlarged. (Original.)



being the most active during the hottest sunshine and quiet in the early evening. \* \* \* The female lays her eggs morning and afternoon, mostly on the stalk of the plant just below the ground. She extends her abdomen into the crack of the ground about the stem of the plant, and most of the eggs that I have seen were from one-fourth to half an inch below the surface. Often, however, they were observed a foot above the ground and in a few instances were observed upon the petioles of the leaves." Later observers have noticed that in case of old plants the eggs are laid on almost any part. The moths remain about for some time, continuing to lay eggs, and have been found in the vicinity of Jamaica as late as September 1.

The eggs are easily recognized. They are oval and of a dull red color. In about 10 or 15 days they hatch, and the young larvæ burrow almost immediately into the stem or roots as the case may be. A single vine may harbor a number of larvæ, as high as 142 having been reported as found in one vine. They do not devour the tissue as much as would be at first supposed, but live within the plant in a mass of decay and excrement.

In about four weeks the larvæ are full grown. The latter part of July\* or first of August they begin leaving the vines to bury themselves in the ground, usually about three inches below the surface, where they spin tough silken cocoons, sometimes interwoven with bits of the vine. In appearance the cocoons resemble oblong chunks of dirt. In this condition the larvæ remain over winter, but do not usually change into the pupa† state until a short time before emerging in the spring. The pupa cuts its way out of its prison by means of a chisel-like process on its head, and wiggles to the surface of the ground during the night, emerging in the morning as a mature moth.

### Remedies.

As the larvæ live within the vines, except for a short time immediately after coming from the egg, the application of insecticides, however efficient in other cases, would be of little or no value here.

\* One half-grown larva was found October 10 in a field near Jamaica. It had not left the vine. Other instances of finding them in the vines late in the fall are numerous.

† See note, p. 720. By cutting through the tissue connecting the top and root of the plant they interfere with the growth of the vine, frequently causing it to suddenly wilt and die, as stated on a previous page.

In small gardens the practice of cutting the borers out as soon as the vines begin to show signs of injury, has been found to be a thorough and practical remedy. If the part is immediately covered with moist earth the vines do not seem to suffer injury from the wound. Some growers practice covering the base of the vine as far as the third or fourth joint to strengthen the growth. Mr. J. V. D. Walker, of Jamaica, L. I., who has closely observed the habits of this insect, was the first to recommend capturing and killing the moths as a practical remedy, especially in small fields. They may be found sitting on the leaves after about six o'clock in the evening and before the sun is high in the morning, and as they are very sluggish at these times, may be easily captured and killed. It would be necessary to repeat this operation many times, but a little labor spent in this way every day would materially lessen the number of eggs and hence the number of borers. The eggs, also, should be watched for and destroyed.

Many farmers delay planting their late squashes as long as possible, without endangering the crop. The field should be fertilized heavily to give the vines a vigorous growth. From all appearances those farmers on Long Island who have had the best success in combating this insect, are those who have watched for and destroyed eggs, larvæ and moths, the moths being captured as before suggested. This treatment must be persisted in, however, in order to be effectual. At present we are unable to mention any other preventive or remedial measures, as but little opportunity has been given for observation and none for experiment.

#### THE BOREAL LADY-BIRD BEETLE.

(*Epilachna borealis*, Fabr.)

The boreal lady-bird beetles appeared in great numbers on Long Island last summer. They were especially numerous in the vicinity of Glen Cove, but were also found in more or less abundance on the western half of the island. It is desired to call special attention to this beetle as it is becoming more and more abundant every year but is not generally recognized by the farmer.

In some respects it is an insect of unusual interest. It belongs to a family of beetles which feed, both in larva and mature forms, on distinctively animal food, such as plant lice, and the eggs of

other insects. By devouring these, as they do in great numbers, they are beneficial to the agriculturist and should be recognized as such. This particular species, however, has taken to vegetable food, and as it preys upon some of our most important crops and is increasing in abundance every year, it is likely to be a serious pest unless an effort is made to check it. The beetles above referred to are commonly known as lady-bird beetles and scientifically as the *Coccinellidæ*.

The eggs are deposited in patches on the under side of the leaf and are easily recognized by their bright yellow color. The larvæ are slug-like in appearance, yellow in color and have black, branching spines. The beetles average nearly three-eighths of an inch in length, are almost as broad as long and very convex. In color they are bright yellowish brown, but have four black spots on the thorax and seven on each wing cover (elytron), two of which are situated on the suture where the wing covers join. Fig. 1 represents the adult.

The eggs hatch in about 12 days. The larvæ feed on the under surface of the leaves but do not eat clear through, while the adults feed on the upper surface, eating off the outer portion in semi circular patches. The injured portion of the leaves soon wither, indicating where the insects

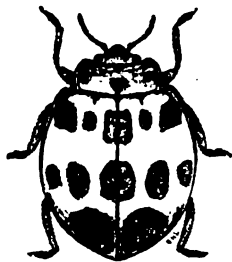


FIG. 1.—The Boreal Ladybird Beetle.

have been. I have been unable to ascertain thus far how long the larvæ feed and remain in the pupa state in this vicinity. Mr. Falconer, of Glen Cove, says that the beetles appear in that vicinity very suddenly, and usually in great numbers, doing considerable damage, especially to squash and pumpkin vines. They are first seen about the latter part of June. During the winter they conceal themselves in almost any place that will afford shelter, such as between the boards of outbuildings, under sticks, chunks of wood, shocks of corn, etc.

### Remedies.

Early in summer they should be carefully watched for and promptly dealt with. Fortunately these insects feed openly, and as they devour the tissue, the application of poisons, such as Paris green or London purple, will have the desired effect. Either of

these may be used at the rate of one pound of the poison to from 150 to 200 gallons of water, adding two pounds of fresh slaked lime to prevent injury to the foliage. Destroying the eggs, larvæ and adults early in the season especially, should not be neglected.

#### THE MELON LOUSE.

(*Aphis cucumeris*, Forbes.)

It has been impossible to ascertain definitely whether this insect has yet appeared in any considerable numbers on Long Island or not. It is, however, a well-known pest in New Jersey, although probably a new comer in the east. The melon louse was first described several years ago by Prof. S. A. Forbes of Illinois in his Twelfth Annual Report as Entomologist for that State, and is there characterized as "a minute, very sluggish, green or greenish-black insect, occurring in immense numbers from spring to late summer, on the under side of the leaves, and also

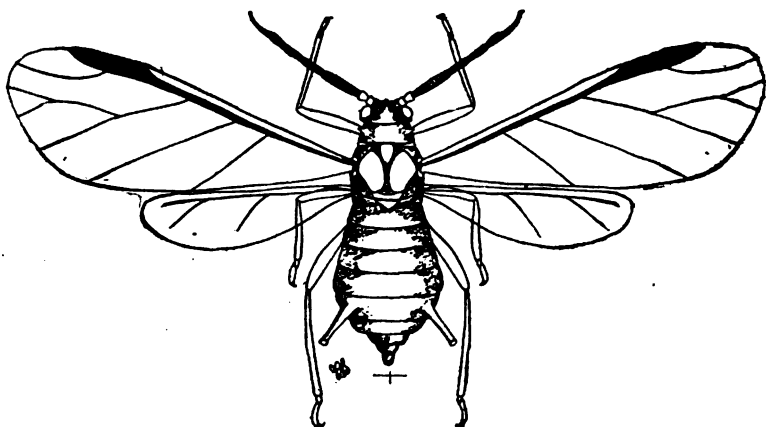


FIG. 2.—Melon Louse, winged viviparous female. (After Prof. J. B. Smith.)

upon the roots of muskmelons, cucumbers, squashes and other cucurbitaceous plants, causing the leaves to curl and shrivel and lose their color and greatly hindering the development of the plants." As it has been impossible to ascertain the life-history of this insect, as it occurs on Long Island, the matter will be left for future investigation.

In all probability this is one of the insects which annually tax the farmer without his suspecting it. It is hoped that another season will reveal the truth of the matter. When abundant it is a serious pest to melon, citron and cucumber vines, and is not

infrequently found on pumpkin and squash vines as well. The insect itself is frequently spoken of, in common with the plant lice in general, as the "green fly." Strictly speaking, however, it is not a fly at all, but a true bug, belonging to the same order as the squash bug. Fig. 2 represents a winged viviparous female.

These insects obtain their food in the same manner as the squash bug, that is, by puncturing the tissue and sucking the sap from beneath. As they are very small, it would at first seem that their work would not be sufficient to seriously injure the plant. This would be true were it not for the rapidity with which they reproduce. A single female will soon have a great number of offspring around her, and these, in turn, will very quickly reproduce, until an immense colony or number of colonies are formed. These little insects seem never to satisfy their hunger, but when gorged eject a drop of clear honey-dew from the anal opening and are again ready to renew the attack. Thus the plant suffers from thousands of minute punctures through which the sap is almost constantly flowing. A black fungus grows in this honey-dew, giving the leaves where the insects have congregated a blackened, unsightly appearance.

### Remedies.

No suggestions as to remedies, based on field experiments, can be made at this time, as the work here was begun so late in the season that the insects had disappeared. It is desired that the appearance or suspected appearance of this insect on any part of the island will be reported at once to the entomologists of the Station. On badly affected vines a spray of kerosene emulsion, if thoroughly applied, will prove effective in dislodging and destroying the lice. The emulsion may be used at the rate of one part of the emulsion to from 12 to 15 parts of water. Owing to the curling of the leaves it is not an easy matter to reach the lice with a spray, and hence much pains should be taken to do the work thoroughly. A knapsack sprayer has been found very convenient for such work as this. The sprayer referred to is manufactured by W. & B. Douglas, of Middletown, Conn., and cost \$10. It is made of copper throughout, and is provided with an underspray nozzle by means of which the spray is directed to the underside of the leaf. Cheaper sprayers of a similar nature are on the market however. Whale oil soap is also recommended.

and should be used with water at the rate of one pound of soap to six gallons of water, and applied in a spray in the same manner as the kerosene emulsion. In addition to this the vines should be frequently examined and the affected leaves plucked and destroyed. The above remedial measures are suggested because they have proved beneficial in dealing with other similar insects.

### THE STRIPED CUCUMBER BEETLE.

(*Diabrotica vittata*, Fabr.)

This little yellow and black beetle has been very abundant on Long Island this past season. In the vicinity of New Lots, Jamaica and Queens it was found doing much damage to cucumber vines. It feeds freely on many other of the cucurbitaceous plants, however, and has been for some time a very troublesome pest in Michigan, Ohio, Iowa and other of the central and western States.



FIG. 3.—The Striped Cucumber Beetle.

Although very generally known, I am inclined to think that this beetle is little suspected by Long Island farmers in general as being injurious. It belongs to a very large and important order of insects known as the Coleoptera, but to a different family from that to which the boreal lady-bird beetle belongs. The mature insect is not large, being only about one-fourth of an inch in length. It is yellow in color, with two black stripes running the whole length of each wing cover and a third one along the suture where the wing covers come together. The larvae are about two fifths of an inch long, very slender, white in color, with a brown head and obtuse proleg behind. Fig. 3 represents the adult.

### Life-History and Habits.

The beetles appear early in the spring and, for the time being, are to be found feeding on a great variety of plants. As soon as cucumber vines appear, however, they desert everything else and attack these, at times even burrowing into the ground to meet the tender shoots. The eggs are said to be laid below the surface of the ground, usually on the roots of the host plant.

The larvæ attain full growth in about two weeks, when they go into the ground and form cocoons in which they remain about two weeks, emerging at the end of that time as the mature or beetle form. As the beetles were found very plenty quite late in the season, it is probable that there are more than two broods on Long Island.

The latter part of September a careful search was made for larvæ in a badly infested field of cucumbers near New Lots, a suburb of Brooklyn. No larvæ were found but the beetles were very numerous and had almost destroyed the vines in patches all over the field. Probably one-fourth of the field was injured in this way. In one large spot near the center of the field the vines were withered and dried, but to all appearances the roots were solid and healthy, except for occasional evidences of previous work by the larvæ. At a previous visit to this patch only a short time before but very few beetles were found. Shortly afterward about the same condition of things was observed in a garden near Queens, except that here the petals of the blossoms were badly eaten, and some of the blossoms were half full of the beetles which had gathered there to get the pollen, of which they are very fond. A small patch of pumpkin vines in the same vicinity was similarly invaded. Injury from the adult is not likely to be felt very much, after the vines are well started, unless they occur in great numbers. It is at this time, however, that the injury caused by the larvæ burrowing into the roots and stems is apparent as the vines begin to wilt and have a sickly appearance.

From the above and similar observations, it is quite evident that this insect may prove a very serious pest and hence should be carefully watched for and promptly dealt with.

### Remedies.

In some States extensive growers of cucumbers, melons, etc., practice starting their plants in frames or hot beds in order to give them a chance to get well under way before being exposed to the attacks of the beetle. Others protect the hills by covering them with screens or netting of some kind so as to keep the beetles away from the young vines. Very good plant protectors of this kind are manufactured by Messrs. Sherman and Crouch,

of Sidney, N. Y. The protectors are made of cloth supported by light wooden frames and cost but a few cents each. They have given good satisfaction at this Station.

As soon as the vines are uncovered, however, they should be sprayed with either London purple or Paris green, using, as before directed, one pound of the poison to about 150 to 200 gallons of water with the addition of two pounds of fresh-slaked lime. If it is preferred the poison may be applied dry, being mixed with plaster, air-slaked lime or flour, at the rate of one part by weight of the poison to about 20 parts of plaster or other substance used. In cases where the insects continue to appear in unusual numbers the application of the poison should be repeated several times. Much pains ought to be taken and the work done thoroughly. Tobacco dust, when applied liberally and persistently on the hills and vines, has been found effective in keeping the beetles away. Air-slaked lime also is recommended and should be applied in the same manner as the tobacco dust.

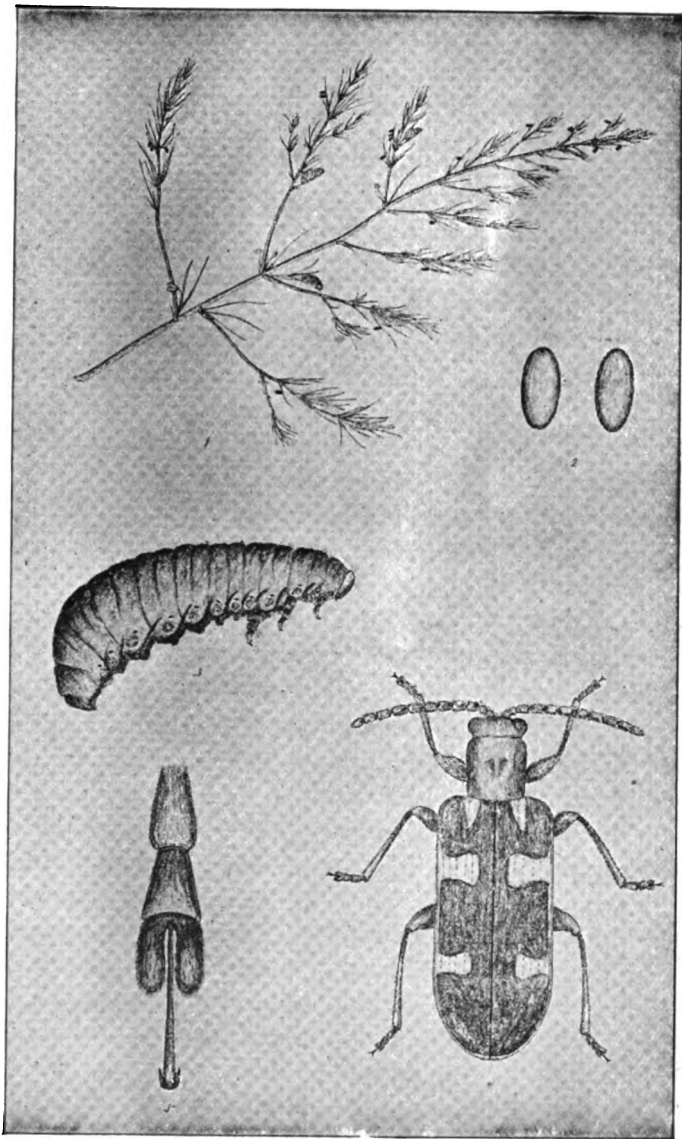


PLATE IV.—The Asparagus Beetle.

Fig. 1.—Spray of young asparagus showing eggs and young larva. 2.—Eggs, greatly enlarged. 3.—Larva, and 4.—Adult, both enlarged; natural length about one-half inch. 5.—Front tarsus, greatly enlarged. (Original)



## II. The Asparagus Beetle.

(*Crioceris asparagi*, Linn.)

For more than 30 years this insect has been a serious pest in the east, and seems to have selected Long Island and the vicinity of New York as a favorite feeding ground. Like many others of our insect pests, the asparagus beetle is not a native of this country, but was brought over from Europe, although from just what part is not positively known. European gardeners, however, are said to be of the opinion that it was first known in Russia. Dr. Lintner, in his first annual report (p. 240), states that this insect was first noticed in this country at Astoria, L. I., in 1859, but that the actual importation of the species was probably three or four years earlier. It was not confined to this section long, however, but spread rapidly over the western section of the island, and from there eastward until it is now found in great numbers from one end of the island to the other. In the vicinity of Jamaica and Queens it was especially abundant in 1894. The asparagus beetle is also found in the western part of the State, from which section it was recently reported to the Station as being very abundant. It is also reported as having been found in Ohio and other of the central States.

The eggs, which are of a dull blackish-brown color, are usually found attached to the plant in rows of from two to five or six. The larvæ are dull ash-gray with a dark colored head. When full grown they measure, as a rule, a little less than one-fourth of an inch in length and are largest toward the posterior end. The beetle although small, being about the same length as a full grown larva, are conspicuous for their bright markings. The head and antennæ are shining black. The second joints of the latter are somewhat smaller than the remainder. The thorax is brick-red with two obscure black marks half way between the anterior and posterior margins. Each wing cover is dotted with nine rows of slight depressions and around each outer margin is an

orange band which is broadest at the posterior border. Three lemon-yellow spots are conspicuous on each wing cover. There is considerable variation in these, however. The body beneath is black, also the legs, except for an orange-yellow ring at the base of each tibia and femur. The ring is much broader in the former. Plate IV represents the insect in all stages from the egg to the adult with the exception of the pupa. Also the peculiar shape of the last tarsal joint.

It may be of interest to note that the asparagus beetle belongs to the same family as the well-known striped cucumber beetle and the Colorado potato beetle.

### Life-History.

The beetles may be found hibernating during the winter in various out-of-the-way places. As soon as the asparagus shoots are up in the spring the beetles appear and begin feeding on them, and the females deposit their eggs on the exposed portions of the shoots. According to Dr. Lintner\* the eggs hatch in about eight days and the larvæ, which are very voracious eaters, are full grown in about 12 days. They then leave the plant and go into the ground to construct slight cocoons from which they emerge in about 10 days, thus taking about 30 days to complete the life cycle. Several broods appear during the season. The larvæ and beetles are quite abundant near Queens August 4, and again in the same field they were observed soon after the 1st of September. As late as October a full-grown larva and several beetles were found at Glen Cove. Both larva and beetles being on a neglected seed-stem.

### Remedies.

Although this insect feeds openly, it is still a very difficult one to handle, and, so far as I am able to learn, comparatively little success has yet attended all efforts to effectually control it. Mr. Fleet, of Cutchogue, L. I., writes that the farmers in his vicinity use Paris green when the insects occur on their new beds. The poison may be mixed with lime or plaster and thoroughly dusted over the beds. In old beds where the asparagus is grown for market, this treatment is not recommended.

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\*First Annual Report on the Injurious and Other Insects of the State of New York, p. 244.

Mr. Falconer, of Glen Cove, says that the free application of lime to the affected beds is in general use in several localities on the island. One or two applications in a season have been found to be of much value. As a preventive measure he practices cutting, carefully raking up and burning the old stalks each fall. This is not only consistent with clean culture but destroys the feeding ground for the fall brood. Especially is this true if the old stalks are cut as soon as the growing season is over. Unfortunately many neglected asparagus beds are to be found on Long Island, thus aiding, to a certain extent at least, in the propagation and protection of this pest. This fall, in a neglected field of this kind near Queens, the stalks were observed to be "alive" with both larvæ and beetles.

Much relief is also afforded by cutting down the young seedlings in the spring. Thus, as Dr. Lintner\* has already noted, the females are forced to deposit their eggs on the young shoots. As these are cut almost daily for market the eggs of what would be the second brood are destroyed.

As chickens are very fond of the beetles, many farmers allow them to run over their asparagus beds. This method is reported from several localities as being a very desirable one.

Asparagus grows wild on Long Island, thus affording food for the beetles when driven from the beds. In spite of this, however, the cleaning up of the beds in the fall, especially if the work is done uniformly by every asparagus grower, would do much to check the spread of this pest. Clean culture is always desirable and a freedom from rubbish on both farm and garden would do much toward subduing not only this but others of our insect enemies.

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\*First Annual Report on the Injurious and Other Insects of the State of New York, page 246.

## PART II.

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# A Lecanium Scale Infesting Plum Trees in Western New York.

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In obedience to a summons from the Director of the Station, the Entomologist came to Geneva November 9, 1894, to study the life history and habits of the "Plum Scale" and to conduct a series of experiments with a view to determining a practical method of combatting this pest.

The work has not yet progressed far enough to enable the Entomologist to give a detailed account of the life history and habits of this insect as a result of his own investigations. Only a brief outline of the experiments is herein given.

The experiments were conducted in the orchards of Maxwell Brothers, of Geneva, and T. Smith & Sons, of Hector, N. Y., these gentlemen having kindly granted the use of a number of their trees for this purpose.

*\*Insecticides used.*—Thus far kerosene emulsion is the only insecticide used in these experiments, as it is considered here in the east to be one of the cheapest and best remedies for this class of insects. It is a powerful external irritant and is commonly used as an insecticide in cases where internal poisons can not be applied to advantage.

As will be seen, the emulsion was used at strengths ranging from one part of the emulsion to four parts of water to one part of the emulsion to 15 parts of water; the object being to determine the strength necessary to kill the insects.

*Method of application.*—The emulsion was applied in the form of a spray. No power sprayers were used in this work as

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\*The emulsion was made in a similar manner to that described on page 413 of bulletin 73 of this Station.

it was found necessary to stop at each tree in order to do the work thoroughly. At Geneva a Clock pump and Vermorell nozzles were used.

*Number of applications.* — Up to the time of writing, but one application of each strength has been made.

*Cost of material and amount used.* — In figuring the cost of the emulsion, kerosene oil was valued at 6.6 cents per gallon (the price paid for it by the barrel at Hector) and soap at 4 cents a pound. The cost of labor is not included. The great variation in the amount of emulsion used per tree is due, in part, to the size of the trees, but largely to the force of the wind.

*Experiments.* — Experiment 1. November 16, 1894, in Maxwell Brothers' orchard at Geneva, N. Y., 67 \*11-year-old plum trees were sprayed with  $44\frac{1}{2}$  gallons of kerosene emulsion diluted to one part of the emulsion to four parts of water. Only a light breeze was blowing, and hence but comparatively little of the emulsion was wasted. Cost per tree (for the emulsion only), .006 cent. In this and the following experiments the trees were drenched with the emulsion from the top to the ground.

Experiment 2. November 17, 1894, in Maxwell Brothers' orchard, 55 trees were sprayed with kerosene emulsion at a strength of one part of the emulsion to six parts of water. A strong northwest wind was blowing, and hence much of the emulsion was wasted. Cost per tree, .007 cent.

Experiment 3. November 19, 1894, in Maxwell Brothers' orchard, 45 trees were sprayed with kerosene and milk emulsion at a strength of one part of the emulsion to six parts of water. This was a very cold and windy day. The emulsion froze upon the trees almost immediately; much of it was wasted. The cost was not figured in this experiment.

The following experiments were conducted in the orchard of T. Smith & Sons, at Hector, N. Y.

Experiment 4. November 22, 1894, 69 trees were sprayed with 125 gallons of kerosene emulsion at a strength of one part of the emulsion to six parts of water. Weather mild with but little wind. Cost per tree, .0135 cent.

Experiment 5. November 22, 1894, 69 trees were sprayed with 125 gallons of emulsion diluted with nine parts of water to one

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\*All the trees sprayed in this orchard were 11 year-old trees.

of emulsion. Weather, same as in experiment 4. Cost per tree, .009 cent.

Experiment 6. November 23, 1894, 85 trees were sprayed with 150 gallons of kerosene emulsion diluted with 12 parts of water to one of emulsion. The weather was cold and very windy. Cost per tree, .006 cent.

Experiment 7. November 23, 1894, 71 trees were sprayed with 150 gallons of kerosene emulsion diluted with four parts of water to one of emulsion. Weather same as experiment 6. Cost per tree, .021 cent. Owing to the wind much of the emulsion was wasted.

Experiment 8. December 13, 1894, 150 trees were sprayed with 150 gallons of kerosene emulsion diluted with 15 parts of water to one of emulsion. The weather was mild with but very little wind. Cost per tree, .003 cent.

Nearly every tree sprayed both at Hector and Geneva were badly infested with the scale. The old mother scales were dead but the young larvæ were hibernating in great numbers on the undersides of the twigs and in crevices in the bark of the trunks and large branches.

We are unable at this time to determine what percentage of the scales were killed by the treatment, but it is expected that a more detailed account of the experiments together with results will be published in the fall.      .

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REPORT  
OF  
ENTOMOLOGICAL WORK.

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F. A. SIRRINE, ENTOMOLOGIST.

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# I. Insects Affecting Late Cabbage.

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## INTRODUCTORY.

All branches of industry and science have terms and names peculiar to themselves. This is especially true of Entomology. As the terms used in Entomology are liable to be confusing to persons who are not familiar with them, a brief explanation of some of those used in the following paper is given. As a general rule, nearly all insects have four more or less distinct stages or periods in their life: *First*, the eggs; *second*, the larva (grub worm, caterpillar, slug, maggot, etc.); *third*, the pupa (cocoon and chrysalis, pupa case, resting stage, puparium, etc.); *fourth*, imago (adult, beetle, bug, butterfly, moth, wasp).

This report of insects infesting late cabbage treats of the following species:

European Cabbage Butterfly (*Pieris rapæ*).

Cabbage Plusia, or Cabbage Moth (*Plusia brassicæ*).

Cabbage Plutella (*Plutella cruciferarum*).

Cabbage Aphis (*Aphis brassicæ*).

Green fly (*Rhopalosiphum dianthi*).

Onion Thrips (*Thrips alii*).

Harlequin Cabbage Bug (*Murganti histrionica*).

Zebra Caterpillar (*Mamestra picta*).

Cabbage Pionea (*Pionea rimosalis*).

Southern Cabbage Butterfly (*Pieris rapæ*).

## THE EUROPEAN CABBAGE BUTTERFLY.

*Pieris rapæ*, LINN.

(Ord. LEPIDOPTERA : Fam. PAPILIONIDÆ.)

“The European cabbage butterfly,” or, as it is often called, “The Imported Cabbage-worm,” is too well known in the butterfly and caterpillar stages to need a description. The egg is not so well known, and as the cocoon of one of the parasites\* of this caterpillar is often mistaken for the egg, a figure of each is

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\* *Apanteles glomeratus*.

given. (Figs. 1, 2, Plate I.) Without exception this is the worst cabbage pest that market gardeners have to contend with. As is pretty well known, it was introduced into this country from Europe about 1857, and, like most of our foreign insects, increased very rapidly for a few years. This rapid increase was probably due, partially at least, to the fact that its native enemies were not imported with it; but as it crowded the American cabbage butterfly to the wall, the enemies of the latter attacked it. In sections of the country where only one crop of cabbage is raised in a year, the parasites keep its numbers reduced so that it is not considered a serious pest. In sections where two or three crops of cabbage are raised every year it is still a formidable pest. Observations on Long Island the past fall have shown, however, that not more than one-tenth of the larvæ of the last broods reached maturity. Their numbers were not only reduced by parasitic enemies, but by a disease.

Three broods a year of this insect are reported as far north as Vermont and Massachusetts. There are at least four broods on Long Island, if not five, in a year. The eggs and larvæ have been found as late as November 19.

The damage, as estimated by a writer for the *American Agriculturist* in 1870, was \$1,000,000 in the vicinity of New York city. Although this was a rough estimate, it must be as much as that at the present date.

**Life-history.** The egg which is shown at Fig. 1, Plate I, is deposited on the early cabbage and on mustard. The larva hatches from the egg in about six days. The first act, according to Dr. Fitch, is to devour the egg shell. It next spins for itself a silken mat or web to which it can cling while feeding. These webs can be seen easier than the caterpillars as they glisten. Remedies should be applied at once. After feeding about 14 days and molting three times the larvæ crawl to any dry rubbish or fence where they can change to pupæ. They remain in the pupa stage about 12 days when the case splits along the back and the butterfly issues. The last brood is supposed to pass the winter in the pupa state, but from the number of young butterflies seen pairing as late as November 10, it seems more than probable that these females will hide away in rubbish and survive the winter the same as a number of our native butterflies do.

**Remedies.** Curtis, in "Farm Insects;" Boisduval, in *Entomologie Horticole*; Duponchel, in "Iconograph of Caterpillars;" Dr. Fitch, New York's first State Entomologist, and in fact nearly all entomological writers since the time of those above named, recommend capturing the adult butterflies with a hand-net. This, in fact, seems to be the most practical preventive that can be used. If market gardeners would give a bounty of, say, 50 cents per 100 for all cabbage butterflies caught between the 1st of March and the 1st of June, the money so invested would yield large returns by the end of the year. Each butterfly lays at least 100 eggs, probably 300; for the sake of an estimate suppose 100 eggs which survive to make adult butterflies, allowing that one-half in each brood are males. Then, from one butterfly, in the second brood there would be 2,500; in the third, 125,000; and in the fourth brood, 625,000 female butterflies. If turnips, radishes, or some other plant of the mustard family that flowers early in the season were set on the borders of the cabbage field the butterflies could be caught on these and thus avoid the liability of injury to the cabbage plants by the boys chasing the butterflies over the field.

Without doubt Paris green and London purple are the most reliable remedies to be used; that is, they can be depended upon to kill caterpillars that feed upon cabbage. Their use in powder form has been generally recommended especially in preference to using them in water alone, as it is difficult to make water adhere to the leaves of cabbage. But, as shown by experiments made on the cabbage moth larva late in the season, the indications are that it is best to use the above remedies in the wet form, prepared as given in formula in article on insecticides on a subsequent page. As shown in the following experiments, if applied in powder form while the dew is on, as thick as farmers usually apply "slug shot," or if a light shower should follow their application they are liable to injure the foliage.

The following experiments, though a part of a number of disconnected experiments which were primarily intended to test the killing properties in field and in laboratory of a number of the arsenites, show reasons for the above estimates:

September 25. Sprayed a plat of 220 cabbage plants with Paris green, also sprayed the same number of plants with London

purple, both prepared according to formula given for water mixtures of Paris green and London purple on page 763 of this report, except that one-third pound more of each poison was used. Each plat contained about an equal number of heads of the smooth and curled varieties. The mixtures were applied with a knapsack sprayer which has no agitator. The mixtures settled some, so that the first heads sprayed in each case were thoroughly smeared with the lime and arsenites.

September 28. No signs of injury by burning on any of the plants. In both cases more of the European cabbage butterfly caterpillars are dead than of the Cabbage-moth caterpillars.

October 2. No injury to any of the plants sprayed September 25. Some lime still adheres to the plants after a heavy shower of the 29th.

A series of tests made in the laboratory by simply spraying the leaves of cabbage with an ordinary atomizer, showed more conclusively than the field test that lime aids the mixture in adhering to the foliage, as well as preventing injury by burning.

October 2. While the cabbage was covered with dew about 150 heads were dusted with Paris green, one part to 15 parts flour. Treated same number of heads with London purple, one part to 15 parts flour. Applied the above powders with a "powder gun," as thick as "slug shot" is usually applied. Each plat contained an equal number of smooth and curled varieties.

October 6. Leaves of both varieties of cabbage burned in both plats. The Savoy variety injured the worst.

October 17. Repeated experiment of October 2 under same conditions, except that the dew was off.

October 19. Light shower.

October 22. Each patch is burned slightly, especially the Savoy varieties.

It follows without proof that neither flour nor road dust will prevent free arsenic in Paris green or London purple going in solution if applied while the dew is on, and if applied when the plants are dry it adheres to the upper surface of the leaves and is no more efficient than when applied in water alone at least against the cabbage moth.

Some of the market gardeners use Paris green as strong as one pound to 80 gallons of water for potatoes. There is no danger

to the plant in using it as strong as this if it is mixed with lime water. The lime should be water-slaked and not allowed to dry.

As consumers are sometimes prejudiced against the use of arsenic, neither London purple nor Paris green should be used on cabbage after the heads are one-half grown. Numerous other remedies have been used, many of which are mere makeshifts. The apparent success of many of these is doubtless due more to the work of natural agencies than to any real virtue of the remedies. The following is a list of some of these remedies:

Road dust, meal, flour; decoctions of alder, dog fennel, knotweed and smartweed; lime, salt, ashes, brine, lye, black pepper, Cayenne pepper, hellebore, Persian insect powder, oxide of silicate, "par odium," cresylic acid, carbolic acid, Pyrethrum, hot water, kerosene emulsion, and slug shot. All of the above-named remedies, except the last, kill by being brought in contact with the body of the insect. For this reason some of the larvæ are sure to escape. Many of the gardeners on Long Island use slug shot instead of using Paris green. The active principle in this is arsenic, the same as in Paris green, and is as dangerous as the latter if enough of it is used. In many cases this is as unreliable as road dust. Samples of it tested in the laboratory the past fall would not kill the larvæ except when put on so thick as to smother them.

#### NATURAL AGENCIES WHICH ASSIST IN THEIR DESTRUCTION.

**Parasites.** Figure 2, Plate I, shows the cocoon of a small wasp-like chalcid fly, attached to a caterpillar. This is known as *Apanteles glomeratus*. It aids in destroying large numbers of the "cabbage caterpillar" at least during dry seasons. This parasite is a delicate four-winged fly armed with a lance-like ovipositor with which it can penetrate the skin of the caterpillar and deposit its egg within the body of its host. These eggs hatch into footless maggot-like larvæ, which feed on the fluids but not on the vital organs of the caterpillar. When full grown these larvæ bore through the body wall and spin a silken cocoon on or near the caterpillar; within the cocoons they change to a chrysalis and finally back to the small four-winged fly. At the time these parasites leave the body of the caterpillar the latter dies. The cocoons are light yellow in color and have been mis-

taken for the eggs of the cabbage butterfly. Some people even think they are the eggs of the caterpillar, which is an impossibility.

Another valuable native parasite is *Pteromolus puparum*; which according to W. B. Alword\* deposits its eggs in the caterpillar just before the latter changes to a chrysalis. As in the preceding parasite the eggs hatch into footless maggot-like larvæ, but in this case they feed on all of the soft parts of the chrysalis, which soon changes to a peculiar brown color and becomes hard and lifeless. The parasites change to pupæ within the chrysalis. When they hatch they have to bore through the chrysalis walls. From two to three hundred of these parasites have been bred from a single chrysalid. If, as has been recommended by some writers, the chrysalids of the cabbage butterfly are gathered to be destroyed, instead of being crushed they should be placed in a box and covered with mosquito netting. The parasites can escape through the netting as they hatch, and the butterflies will perish in a few days.

These two parasites are delicate insects and probably the heavy rains in early summer prevent their increase in numbers sufficient to check the increase of the cabbage butterfly.

**Bacterial disease—Micrococcus of the cabbage caterpillar.** This disease was first observed by Dr. Forbes at Normal, Illinois, in 1883. He is of the opinion that it was first noticed in the vicinity of Washington, D. C., by Dr. Riley, in 1879, although the latter evidently did not realize what it was. It is apparently similar to the "*Flacherie*" or "*Schlaffsucht*" of the silk worm; that is, it is due to a micro-organism.

The disease can be quite accurately distinguished by external appearances. In the first stages the caterpillars change from their natural, lively green color to a paler green. In a short time they have an ashy hue and are sluggish. Immediately after death they change to a sooty gray, the body contents change to fluid, the skin breaks easily and the dirty fluid becomes smeared over the surface of the leaf.

That it is a contagious disease we have only indirect proof. It has been observed in Illinois and Iowa for the past 10 years. Usually it seemed to start in warm, dry seasons, in August or

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\* U. S. Div. of Ent. Bull. No. 13, 1886, pp. 50-51.

September, occurring in some localities and not in others. If the dry spell continued long enough the disease would appear in other fields, which, of course, was an indication of its spreading.

Artificial cultures of the disease have been obtained by Dr. Forbes, of Illinois, and at the Iowa Experiment Station. Inoculations have been made from these cultures in both of the States, but in every case the appearance of the disease in the fields has interfered with carrying the experiments far enough to obtain positive results. Still another cause which has interfered with the determination of the contagious character of the disease is the fact that no resting spores of this *Micrococcus* have been obtained in artificial cultures. During the fall of 1893, at the Iowa Experiment Station, a number of the diseased larvæ were obtained from the field and placed in a dry atmosphere until they became mummified. The past season Mr. Charles W. Malley, of the above Station, made cultures from these mummified larvæ. As far as microscopical characters and method of growth on culture media could be relied upon, the pure *Micrococcus* of the cabbage-worm disease was obtained. Some of the above cultures were obtained from Mr. Malley and bouillon, or beef tea, cultures were made from these. On August 22 a number of larvæ of *Pieris rapæ* and of the cabbage *Plusia* were taken to the laboratory from the field of Mr. Van Dine and placed on cabbages growing in flower pots. The bouillon was sprayed on the leaves and larvæ. By August 27 all the larvæ of the imported cabbage worm were dead, while *Plusia* did not seem to be affected in the least. In a second case the bouillon was sprayed on the cabbage and the larvæ placed on the plants afterward. On August 27 all these larvæ were dead except one which had pupated. In the first case the bouillon culture was sprayed on the plants full strength; in the second it was diluted with water 10 parts to one of the culture.

On August 29 when Mr. Van Dine's cabbage field was revisited to obtain a new lot of material to work with, the disease was found raging at a frightful rate. This of course put a stop to work with material from that field and deprived the test of all certainty.

A second attempt was made September 12 on material obtained from Mr. Van Dergau's near Queens, L. I. The old

bouillon culture of August 14 was used. It was applied full strength to the leaves in a fine spray, allowed to dry and then six larvæ of *Pieris* were placed on the sprayed cabbage. On September 20 only two of the larvæ had died apparently from the disease; the rest had pupated. An experiment parallel with this was made by applying the spray to the leaves of the cabbage while the larvæ were on the plant. Of the six larvæ so treated only one died with symptoms of the disease; one was killed by parasites and the rest pupated. Two checks were carried with the above tests in each of which several died from parasites and the rest pupated. No further attempts at artificial inoculation were made after this date as no fields were found where a few diseased worms could not be obtained. In the last experiments it is probable that either the bouillon culture had lost its virulence or had become contaminated by other germs. The laboratory was not fitted for such work so it was next to impossible to keep pure cultures.

As previously stated the reasons that no positive, direct proof of the contagious character of the disease has yet been obtained are: 1st. The difficulty of carrying the disease on culture media and retaining its virulence over winter. 2d. The difficulty of obtaining healthy caterpillars to treat after cultures of the disease were obtained. It is to be hoped that a trial with the disease may be made on Long Island with the first brood on early cabbage, before it gets started in the fields. In fact, this will be the only way of making field tests of the disease. If it should prove a success it would be necessary to test the germ thoroughly on higher animals before it can be recommended for general use. Of course we have a partial test of this from the fact that germs of the disease have been on cabbage for the past 10 years and probably longer. No ill effect could result from thoroughly cooked cabbage. Like all diseases and parasites it can only act as a check to the increase of the cabbage butterfly.

**Conclusions.** Care should be used not to destroy the parasites of the cabbage caterpillar, yet it should be remembered that these act merely as checks to their increase and can not be expected to exterminate them.

Preventive measures are worth more than all the named remedies, although applied at one time. If capturing is not practical,

the persistent use of Paris green on the first crop while the larvæ are small should be resorted to, even if but few butterflies are to be seen. There is nothing more true in the struggle between the gardener and the cabbage butterfly than the old adage, "An ounce of prevention is worth a pound of cure," and the result of neglect is a riddled crop of cabbage and a cursing from one's thrifty neighbors.

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### THE CABBAGE PLUSIA, OR CABBAGE MOTH.

*Plusia Brassicæ*, RILEY.

(Ord. LEPIDOPTERA; Fam. NOCTUIDÆ.)

This is a native moth, but is not as well known by gardeners as the cabbage butterfly; in fact, the injury which it does to late cabbage is usually considered to be the work of the larvæ of the cabbage butterfly.

The cabbage moth was first described by Dr. Riley\* in 1870.

Undoubtedly it does more damage to late cabbage and lettuce on Long Island than the cabbage butterfly, as, in this locality, it is not checked by parasites. The larva is especially injurious to lettuce when the latter is transplanted from cold frames or open beds to the forcing-house.

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\* Second Report of Insects of Mo., C. V. Riley, 1870, pp. 110-112.

In Europe, according to Curtis,\* there is a *Plusia* called the Y-moth (*Plusia gamma*), which ruins the turnip crop in some seasons. This is closely related to our cabbage moth. It has been noted in France that this species increases more rapidly in wet than in dry seasons; also, that it flies in the day-time regardless of the character of the weather. Our native species is surely not as partial to wet weather, for it was found quite abundant on cabbage near Queens, N. Y., as early as September 10; still the cold rains of October and November evidently did not check their increase in the least.

Dr. Thomas, in his Fourth Report on Insects of Illinois, says: "Unlike most noctuids, *Plusia* flies during the day instead of the night." Other writers state that it flies only at night. Both statements are probably true. They have been observed the past fall flying around radish and mustard flowers in the late afternoon. As late as November 5 they were noticed flying around flowers at noon, but in all cases those taken at flowers were male moths. The females are very shy and were not seen on the wing except when frightened from their hiding places.

**Food plants.** Dr. Riley† gives cabbage, *Crepis*, clover, dandelion, German ivy, *Chenopodium*, kale, tomato, mignonette and dock as food plants. Dr. Lintner‡ adds turnip, lettuce, celery and Japan quince, and has had it reported to him as feeding on parsley, heliotrope and *Pelargonium*. To these may be added spinach, on which plant it was found feeding late in October, near Jamaica, N. Y.

**Life-history and description.** Like the cabbage butterfly it deposits its eggs singly on the outer leaves. The eggs are turnip shaped and ribbed, and in color nearly pure white. Figure 3, Plate I, shows an egg magnified about 20 diameters. They are about the size of a mustard seed. The length of time required for the eggs to hatch does not seem to have been noted by any entomologist.

The caterpillars are not provided with prolegs on the sixth and seventh segments like most Noctuids, so in traveling over the

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\* Farm Insects, by John Curtis, F. L. S., etc., 1860, pp. 88-90.

† Bull. No. 6. U. S. Entomological Commission, 1881, p. 78.

‡ Second Annual Report Noxious and Other Insects of N. Y., 1885, p. 91.

surface of the leaf they loop the body like the "Measuring Worms" or "Geometers." From this habit they are sometimes called "Cabbage Loopers."

Like the cabbage caterpillar they are only satisfied with feeding while very young on the outer leaves of the cabbage. As they increase in size they work toward the center of the head, and, if these are not fully formed, they will work into them as bad or worse than the cabbage caterpillar does. When about one-fourth grown the caterpillars or larvæ are nearly as dark green as the cabbage caterpillar, but are distinctly marked with white longitudinal lines. When half to two-thirds grown they have changed to a light green and the markings are not distinct. There are very few hairs on the body. Two sizes of the larva are shown at Figure 5, Plate I. When full grown the caterpillar, instead of crawling away to pupate around some old fence or dead weed, like the imported cabbage caterpillar, crawls to the underside of a leaf, usually one of the outer leaves of the cabbage, spins a thin silken cocoon and changes to a chrysalis. The chrysalis can be seen through the cocoon. It changes from the chrysalis to the adult moth in 10 days or two weeks.

The male moth differs from the female by having a conspicuous tuft of brown hairs on each side of the abdomen near the caudal end; also in having the white marks on the fore wings in the form of a dot and a V-shaped mark, while in the female the mark resembles the figure 8. These differences are nicely shown in Figs. 4 and 4<sup>1</sup>, Plate I. The hind wings in both male and female are mouse colored, with the margins fringed with white and fawn colored hairs. Dr. Lintner\* states that there are only two broods of this moth a year. The larvæ were observed here in large numbers as early as September 10. Moths issued in laboratory as late as December 1. Eggs and larvæ were found on cabbage as late as November 19. From the number of caterpillars found by September 10, it would seem that these must belong to the second brood; if so, there must be at least three broods a year on Long Island.

Dr. Thomas† expresses the opinion that they hibernate in the adult stage. At least part of the last brood passes the winter in

\* Sixth Report on Injurious and Other Insects of N. Y., 1890, p. 184.

† Ninth Annual Report Noxious and Beneficial Insects of Ill., 1880, p. 43.

the pupa state, but there seems to be no reason to doubt that the adults can hibernate in rubbish, or in the leaves of the cabbage left on the fields all winter, as part of these plants become partially covered in plowing and live over winter.

**Remedies.** Catching the moths with a hand net has been recommended, but it is entirely impractical. As already stated, the female moths are rarely seen; this is especially true in the spring. Light traps may prove practical, but there is no record of their being tried. With the exception of the above-named preventives the same remedies should be applied for *Plusia* as for the cabbage butterfly caterpillar. The application of these poisons must be more thorough and as strong as the plants will bear, because, if *Plusia* gets a particle of food that disagrees with him he travels to new feeding grounds. In the series of experiments with Paris green, London purple and "Slug Shot," used in a dry form (part of which are given in the article on cabbage butterfly), no results worth mentioning were obtained on *Plusia*, as the larvæ would travel to parts of the plants where powders could not be applied. Better results were obtained by the use of Paris green and London purple, with water and lime although tests with these in the laboratory indicated that the killing properties of both were lessened by the lime. This was especially true with the London purple.

#### NATURAL AGENCIES WHICH ASSIST IN THEIR DESTRUCTION.

**Parasites.** A few chrysalids have been found the past fall at Jamaica N. Y., which appear to be infested by *Pteromalus puparum*, but nothing has been bred from them, nor were any larvæ found that showed any indication of parasites. Curtis states that to his knowledge the Y-moth has no parasites.\* Parasites have been bred from *Plusia* by Dr. Riley and Prof. Howard, and an egg parasite by Prof. Ashmead. These parasites were obtained in the southern half of the United States.

**Diseases.** Prof. Osborn† mentions the occurrence of a disease on *Plusia* at Ames, Iowa, during the fall of 1892. This was the only check to this pest observed on Long Island the past fall. Sickly specimens were first noticed October 27 on cabbage. Later

\* Farm Insects, 1860, pp. 89-90.

† U. S. Dept. Agriculture, Div. of Ent., Bull. No. 30, 1893, p. 43.

it was found in several localities very virulent on larvæ feeding on lettuce, especially in cold frames. The first outward symptoms of the disease is the yellowish appearance of the larvæ. At death they are ashy grey. In addition to the color they are firmly fastened by the prolegs and hang with head downward. They soon change to a dirty putrid mass the same as the cabbage caterpillar when affected with the bacterial disease. But instead of thriving during warm weather like the disease of the cabbage worm, this later disease did not appear until the cold wet weather of October and November set in.

**Conclusions.** First. The cabbage moth did more damage to late cabbage on Long Island in 1894 than the cabbage butterfly. It is liable to ruin late crops of lettuce, especially transplanted crops.

Second. Apparently it is three-brooded on Long Island, and probably hibernates both in the adult and pupa stages.

Third. Paris green mixed with lime water is the surest remedy for it.

Fourth. It has but few natural enemies on Long Island, but is attacked late in the fall by a virulent disease.

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Riley: Bull. No. 6, U. S. Ent. Commission, General Index and Supplement to the Nine Mo. Reports (1881), pp. 77, 78.

Packard: Report Rocky Mt. Locusts and other Insects, Dept. Interior U. S. Geol. Survey, 1877, pp. 752, 753.

French: Seventh Report State Entomologist, C. Thomas, Ill. 1878, pp. 229, 230.

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Lintner: Second Annual Report, Injurious and other Insects of N. Y., 1885, pp. 90-93.

#### THE CABBAGE PLUTELLA.

*Plutella cruciferarum*, ZELL.

(Ord. LEPIDOPTERA: Fam. TINEIDÆ.)

This moth has been described under the following names: "The Web Moth," "The Cabbage Leaf-Miner," "The Diamond-back Turnip Moth," "The Diamond-back Cabbage Moth," "The

Diamond-back Moth," and "The European Cabbage Web Moth."

It is not a native, but apparently the exact time of its importation is not known. In this country it was first observed in Illinois by Dr. Fitch,\* in 1855. From its habit of hiding under a web he described it as "The Cabbage Web Moth" (*Cerastoma brassicella*). He found it in New York in 1869. Several European and American writers state that there are but two broods in a year. Curtis† says: "There is a succession of broods in England." Prof. Gillette‡ found the cocoons on early cabbage in June in Colorado, and says: "There are probably three or four broods in a season." It was observed near Jamaica, N. Y., the latter part of July. Adults and larvæ were found every month from then until November 27, at which time the larvæ were still feeding on cabbage. It was not noticed in injurious numbers the past fall on Long Island. In some seasons it occurs in numbers sufficient to do a great deal of damage to rape and turnips. It is also known to feed on cauliflower and Brussels sprouts as well as on cabbage. It injures cabbage principally in the early part of the season.

**Life-history and description.** No one in this country seems to have noticed the eggs. Curtis, in his *Farm Insects*, figures them in a cluster, but does not mention them in the text. It seems scarcely probable that they are laid in clusters, when the caterpillars are always found feeding separately the same as the larvæ of the cabbage butterfly and moth.

The caterpillar is a pale green worm about one-fourth inch long, with stiff dark hairs scattered over the body. It is usually found hidden under a web. If touched it will fall a short distance and hang by a delicate silken thread. When feeding it usually leaves its web, especially when nearly full grown. Very often, as shown in Fig. 6, Plate I, they do not eat entirely through the leaf tissue. This habit has given them the name of "Cabbage Leaf-miner." When full grown the larva spins a thin cocoon in a fold on either side of the leaf. According to Curtis, who quotes from M. Duponchel, between 12 and 20 days are required for the larva to change to a chrysalis and finally to the adult.

\* Fitch's First Report on Noxious, Beneficial and Other Insects of N. Y., 1853, pp. 170-175.

† *Farm Insects*, by John Curtis, F. L. S., etc.

‡ Bull. No. 24, Colo. Agri. Exp. Sta., 1893.

The moth is rarely seen except when frightened from its hiding place.

The four wings have a white or yellowish white wavy band on the hind margin. When seen at rest these bands are united along the back so as to form three diamond shaped spots. The hind wings are fringed with long hairs. It probably passes the winter in the pupa and adult stages.

**Parasites.** In this country entomologists have bred seven species of parasites from this insect. The most common one found here the past fall was *Limneria tibiator* Cr.\* Apparently it does not sting the larva until the latter has spun its cocoon. After devouring the larva of the *Plutella* the larva of the parasite spins a paper like cocoon within its host. As late as November 27 it was almost impossible to find cocoons of *Plutella* that were not parasitized, besides, the adult parasites were still active at that date.

#### PARTIAL BIBLIOGRAPHY AND SYNONYMY.

- Cerastoma brassicella*, FITCH: First Report on Noxious, Beneficial and Other Insects of N. Y., 1855, pp. 170-175.
- Cerastoma xylostella*, CURTIS: Farm Insects, 1870, p. 85, by John Curtis, F. L. S., etc.
- Cerastoma xylostella*, LE BARON, in "Prairie Farmer," Oct. 8 1870, p. 314.
- Plutella xylostella*, LINN.: Report on Rocky Mt. Locust and Other Insects, Dept. of Inter., U. S. Geol. Survey, 1877, pp. 751, 752, A. S. Packard.
- Plutella cruciferarum*, ZELL.: Seventh Report Ill. State Entomologist, C. Thomas, 1888, Part II, French, p. 267.
- Plutella cruciferarum*, ZELL.: U. S. Dept. Agr. Div. Ent. Bull. No. 14, 1886, p. 12, Ashmead.
- Plutella cruciferarum*, ZELL.: Bull. No. 12, Hatch Exp. Sta., Mass., 1891, pp. 30, 31, C. H. Fernald.
- Plutella cruciferarum*, ZELL.: Bull. No. 18, Iowa Agrl. Exp. Sta., 1892, pp. 514-516, Osborn and Gossard.
- Plutella cruciferarum*, ZELL.: Bull. No. 24, Colo. Agrl. Exp. Sta., 1893, pp. 9, 10, Gillette.

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\* Kindly determined for me by L. O. Howard, United States Entomologist.

**Conclusion.**—This moth will not be apt to be injurious to cabbage on Long Island next year. It is probably three brooded in this locality. Thorough treatment of cabbage with the arsenites for the cabbage moth and the cabbage butterfly will prevent any unusual outbreak of the cabbage *Plutella*.

## CABBAGE APHIS.

*Aphis brassicae*, LINN.

(Ord. HEMIPTERA: Subord. HOMOPTERA: Fam. APHIDIDÆ.)

Probably there is no better known cabbage pest than the cabbage aphis, also known as cabbage louse and "greenfly." This pest has done as much or more damage on Long Island the past season than the cabbage caterpillars, that is, estimating the damage from early spring till late fall. Mr. J. M. Lupton, of Mattituck, who is an extensive grower of garden seeds, states that it caused a large amount of damage to seed cabbage by injuring the seed stalk so that in some places no seed was produced. Mr. Van Dergau, of Queens, made the same complaint. It also caused considerable damage to cabbage in the seed beds.

Many heads of the last two crops of cabbage were actually filthy from the masses of lice on them. It was not an uncommon sight in cabbage fields to see heads with the outside leaves dead and covered with the inflated skins of what had been parasitized aphids; above this would be a few half-dead leaves covered with about an equal number of parasitized and live aphids, while within the withy head would be masses of perfectly healthy lice.

This was especially true of the Savoy varieties. Some gardeners seem to have the idea that this variety of cabbage is freer from insect injury than other kinds. Observations the past fall would indicate that this is simply due to appearances and not fact. Plant lice curl the leaves of all cabbage more or less. The Savoy variety furnishes a natural protection to them. It naturally follows, though, that any variety which forms a solid head rapidly, if given half a chance, will have the advantage over slow heading varieties.

There is also a general opinion that plant lice only thrive in dry seasons. It is known that some root-infesting plant lice cannot live except in boggy, wet land. After a heavy shower the Cabbage Aphis is not noticed on the cabbage as thick as just preceding the storm; but in a day or two they can be seen swarming over the leaves as thick as ever. The rain simply washes them into the folds of the leaves where they may be found piled up and possibly covered with water, but perfectly dry, as the pulverulent secretion on the body protects them. This pulverulent ashy secretion is not only a protection but makes this Aphid easily distinguishable from any other cabbage louse.

**History.** The Cabbage Plant Louse was probably introduced from Europe at an early date. Dr. Fitch shows, by a reference to the Transactions of the New York State Agricultural Society for 1791, that it was a known cabbage pest in this country at that time.

Plant lice differ from most insects in that all broods are not produced from eggs. In general, the first brood of the season hatches from eggs that were deposited by the last brood of the preceding fall. This first brood is composed entirely of so called wingless females. When about eight days old they commence to give birth to young plant lice. The second brood is also composed entirely of so-called females. In many cases the females of the second brood are all winged, and they migrate from the plant on which the eggs were deposited to some other plant, where the third brood is deposited. Here two or three broods, all females, are produced, depending on the length of the season. Next follows a brood of winged females, which migrate back to the plant on which the eggs were deposited the previous fall, and give birth to a brood of true wingless females. The latter, after attaining their growth and pairing with the winged males, deposit the eggs. This, in brief, is the general life cycle in North Temperate regions.

With the cabbage louse it is an unsettled question as to how and where it survives the winter. Prof. Weed\* succeeded in finding a few eggs and males, also the egg-laying females on cabbage in 1889, which he described. This is said to be the first description, but in the Jour. Royal Agrl. Society of Eng. (vol.

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\* Insect Life, vol. II, page 289 (1890).

V, p. 54), will be found a description of the male of *Aphis brassicæ* by Curtis. A number of writers on entomology are quite positive that it must deposit eggs to survive the winter. In the collection of Aphididæ at the Iowa Experiment Station there is a specimen of a male cabbage *Aphis* collected in August. This much is certain, that this *Aphis* survives the winter on cabbage stored in cellars and pits, also that the cabbage stored in pits for seed purposes furnishes the supply of *Aphis* for infesting the seed-stalks in early spring. Prof. Webster\* has found them in February on cabbage in the field in Texas. It is also a fact worth considering that the Cabbage *Aphis* has winged females in all broods observed throughout the summer.

In conclusion, this *Aphis* apparently has been a pest on cabbage in a wild state, where it probably followed the general rule, but owing to its hardy nature and the fostering care of man in developing the cabbage it has lost the habit of producing true females and males at any fixed period. In fact the latter only occur often enough to maintain the vitality of the stock.

The main thing of interest to the gardener is how to get rid of the broods that survive the winter. With this idea in view the following tests were made the past fall.

**Remedies.** First—Bisulphide of Carbon.

September 21, 5:00 P. M. Placed a head of cabbage badly infested with cabbage *Aphis* under a bucket in laboratory. Put about two fluid drachms (two small teaspoonfuls) of bisulphide of carbon in a saucer and placed it under the bucket. This was equivalent to about  $4\frac{1}{2}$  fl. dr. of bisulphide to one cubic foot of air.

September 22, 8:00 A. M. All insects dead. Plant injured.

October 3. Put 50 cabbage heads, that were filthy with plant lice, in a pit 14 feet long, 13 inches wide and 20 inches deep. Two plates were set on the cabbage about seven feet apart. Put 24 fl. dr. of bisulphide in each plate, covered the pit with two boards and buried six inches deep with earth. This was equivalent to two fl. dr. of bisulphide of carbon to every cubic foot of space occupied by air and cabbage plants.

October 6. Took cabbage out of pit. Not a living insect could be found. None of the heads appeared to be injured.

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\* Bull No. 51, Ohio. Agri. Exp. Sta., p. 109.

Through a misunderstanding these cabbage plants were not transplanted, as was intended, to test whether the vitality of the plant was injured by the bisulphide fumes. It is recommended though, that all seedsmen who raise cabbage seed, open the pits a few days before time to set the cabbage in the field, place shallow dishes in the pit, using one for every 10 cubic feet of space, and in each dish put not more than one teaspoonful of carbon bisulphide for each cubic foot of space. Close the pit and leave closed two or three days. Care must be taken not to spill any of the liquid on the plants as it will injure them. Care should also be taken not to use this liquid around a fire or flame of any kind as the fumes are liable to catch fire and cause an explosion. Also remember that the fumes in close quarters are death to all animal life.

A series of tests of the fumes of this liquid on lettuce were made in the laboratory in a tight glass chamber. One fl. dr. to every  $1\frac{5}{8}$  cubic feet of air space killed the Cabbage Moth caterpillar and plant lice. Temperature of the room approximately 65 degrees. Lettuce injured. The least quantity used was one-quarter fl. dr. to every  $1\frac{5}{8}$  cubic feet of space, or approximately one fl. dr. to every four cubic feet of space. This, at a temperature of 50 degrees after three hours' time, killed part of the Cabbage Moth caterpillars, a few revived afterward; it did not injure the plants. For plants as tender as lettuce only one fluid drachm should be used for every three cubic feet of space.

Second — **Other Remedies.** Nearly as many remedies have been recommended for this pest as for the European cabbage worm. It should be remembered that plant lice are only killed by insecticides which smother or kill by contact. None of the poisons will kill them. The best remedy for outdoor purposes is kerosene emulsion diluted with 10 parts water. It should be applied to the lower as well as the upper sides of the leaves, and, if possible, while the cabbage are small. A number of tests of Pyrethrum, Persian Insect Powder and tobacco dust were made in the laboratory. Of these tobacco was found to be the most active killing agent. Pyrethrum and Persian Insect Powder are considered good, but are liable to be adulterated and to lose their strength.

**Food Plants.** At the Queen's County Fair, last September, the following plants on exhibit were infested with the Cabbage Aphis: Kohl rabi, kale, Brussels sprouts, broccoli, cauliflower and cabbage. In addition to these in the field, it was noticed on mustard, ruta-bagas and radish. Prof. Ashmead\* gives field cress (*Isatis tintoria*), Shepherd's purse (*Capsella bursa pastori*) and charlock (*Brassica arvensis*).

**Enemies.** Seven different species of parasites have been reared from the Cabbage Aphis in this country and Europe. These parasites are very small wasp-like insects. The females are all armed with a lance-like ovipositor with which they pierce the skin of the aphid to deposit their egg. After the little larva has attained its growth it usually changes to a pupa within the aphid. In a few cases they issue and spin a cocoon under the dead body of the louse. Parasitized aphids can always be distinguished by the brown paper-like appearance of their bodies when dead.

Aside from the parasites the following insects prey upon plant lice: Tree crickets, Lace-wing flies and several species of diptera (flies) in the larval stage, also "Lady Birds" in the adult and larval form.

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Kaltenbach: Monographie der Familien der Pflanzenlæuse pp. 106-107 (1872).

Buckton: Monograph of British Aphides, pp. 33-35 (1879).

Weed: Insect Life, vol. III, p. 289 (1890).

#### THE GREEN FLY (*Rhopalosiphum dianthi* SCHRANK).

(Ord. HEMIPTERA: Sub. Ord. HOMOPTERA: Fam. APHIDÆ.)

This aphid is the universal "Green Fly" of gardeners. It occurs throughout the fall on the underside of the outer leaves of cabbage and on turnips. It very rarely increases in such numbers as to cause serious injury to cabbage, but entire turnip fields are sometimes ruined by it. Curtis† calls it the "Turnip-leaf Plant-louse," and describes it as *Aphis rapæ*. He also states that in

\*U. S. Dept. Agricultural Div. of Ent., Bull. No. 14, 1887, p. 12.

† Farm Insects, by John Curtis, F. L. S., etc., 1870, p. 68.

[842] between 500 and 600 acres of turnips were destroyed in two localities in England by this aphid. Prof. Davis\* describes it as a "Celery Aphis," and reports it as occurring on celery in Michigan. It is known to occur on a large number of different garden plants and weeds; also to injure most kinds of greenhouse plants if not kept in check. Buckton gives over 60 food plants for it.

The winged females were very numerous in this locality (Jamaica, N. Y.) during the month of October. They were especially noticed because of flying into houses and greenhouses. Lettuce transplanted from cold frames and beds were smoked to give it a start ahead of the plant lice which were already upon it.

This louse is easily distinguished from the cabbage louse, from the fact that its body is not covered with a pulverulent secretion and it is of a livid green color. The antennæ are nearly as long as the body, and black. The cornicles or nectaries reach to the end of the body and are also black.

Like the cabbage louse it has no fixed habits of producing winged females and migrating. Probably it survives the winter principally on greenhouse plants, for Kaltenbach† says, "On pot plants the mother (viviparous female) produces living young throughout the whole year." ("Aus Topfpflanzen bringen die Mutter das ganze Jahr hindurch lebende Jungen.")

The finding of a few egg-laying females on cabbage late in November here on Long Island would indicate though that eggs are sometimes deposited.

**Remedies.** Probably no better remedies can be suggested than those already well known to florists, namely, tobacco dust and tobacco fumes. In the field it should be treated the same as the cabbage louse, especially when occurring on celery.

**Enemies.** This aphid apparently is not infested with parasites to such an extent as the cabbage aphid, in fact, no parasitized specimens of this aphid were found on cabbage the past season. However, they are affected by a fungous disease (*Empusa aphidis*). The latter part of November nearly two-thirds of all the colonies on cabbage were merely yellowish brown masses stuck to the leaves by the threads of the fungus. This disease was also observed on the same aphid on lettuce in greenhouses.

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\* Bull. No. 102, Agr'l Exp. Sta., Mich., 1893, p. 20.

† Monographie der Familien der Pflanzenlause p. 43, 1872.

Complete descriptions may be found in the following works:  
*Aphis dianthi*, SCHR.: Die Pflanzenlæuse, C. L. Koch, pp. 42-44 (1857).

*Aphis rapae*, CURTIS: Farm Insects, John Curtis, F. L. S., etc. p. 68 (1870).

*Rhopalosiphum dianthi* SCHR.: Monographie der Familien der Pflanzenlæuse, J. H. Kaltenbach, pp. 42-44 (1872).

*Rhopalosiphum dianthi* SCHR.: Monograph, British Aphids Geo. B. Buckton, pp. 15-21 (1879).

*Rhopalosiphum dianthi* SCHR.: Aphididae Minn. Oestlund (1880).

### ONION THRIPS.

*Thrips alii* (GILLETTE), BEACH.

(Ord. PHYSOPODA; Subord. TEREBRANTIA; Fam. STENOPTERIDE)

This insect, though known as "Onion Thrips," because first described from onion, might properly be called "Cabbage Thrips."

At a preliminary meeting of the prominent farmers of Long Island, July 21st, when the work of the sub-station was commenced, Mr. J. W. Cain mentioned that a rust was injuring the cabbage. Opportunity to examine this "rust" was found the same day. It proved not to be a rust but the work of a species of thrips. Specimens of this were submitted to Miss Alice V. Beach, of the Iowa Agricultural College, who pronounced them *Thrips alii*. Later in the season specimens of *Thrips alii* were found on onions here and compared with fresh specimens from cabbage proving them to be identical.

Their injury is confined principally to the outer leaves of the cabbage. In ordinary seasons they will probably cause no marked damage, though the past fall their injury was sufficient to cause the outer leaves of the second crop of cabbage to die. Onions is the crop that they injure principally, especially in sections where the crop is not harvested till October. In sections like Long Island, where the crop is started in the fall and harvested earlier in the season, probably they will not be a serious pest, though the past fall some fields of young plants showed the "white blight," which is caused by this insect eating the green portion of the leaves. In fact they apparently left the cabbage the latter part of September and went to onion fields.

Prof. Gillette\* reports this pest as doing serious harm to onions in Colorado during July and August for the past two seasons. It was very destructive to onions in the eastern portion of Iowa during July of the present year.

Dr. Lintner† mentions a thrips on cabbage in his ninth report and considers it a new species.

Prof. Smith‡ mentions a thrip very injurious to onions during the fall of 1890. Probably in both these cases these were *Thrips alii*.

Dr. Packard in his Second Annual Report on the Injurious and Beneficial Insects of Massachusetts describes a thrips injuring onions but he considers it to be the "wheat thrips" (*Limothrips tritici*). He estimated that at least \$10,000 worth of onions in Essex county alone were destroyed by this pest. This does not appear to be identical with *Thrips alii*, but was probably what is now known as *Thrips striatus*. Prof. Gillette in bulletin referred to above treats of the "onion thrips" as *Thrips striatus*? but mistrusting it might be a different species suggests the name of *Limothrips alii*. Miss Beach of the Iowa Agricultural College has since redescribed it and placed it in the genus *Thrips*, calling it *Thrips alii*.

**Description.** It can be distinguished as follows: The wingless forms are light yellow in color and about  $\frac{1}{4}$  of an inch long. The winged specimens are more of an ash color. They run rapidly over the surfaces of the leaf and throw up the tips of the abdomen in a threatening manner; this though is apparently done to aid in spreading the wings. The wings are four in number and when spread for flight as shown in Fig. a, Pl. II, they are seen to be fringed with hairs. (In the figure portions of the body are shaded too much.) The antennæ are seven jointed. The eyes are quite large and dark colored. The main characters for distinguishing this from other species of thrips must be made out with the microscope. The number of antennal joints, the arrangement and number of spines on the wings and abdomen are the main specific characters.

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\* Bull. No. 24, Colo. Agrl. Exp. Sta., p. 13.

† Ninth Report on Injurious and Other Insects of N. Y., 1892, p. 145.

‡ Report Ent. Dept. N. J., Agrl. Coll. Exp. Sta. for 1893, p. 441.

**History.** The eggs are deposited within the tissue of the plants on which the adult thrips feed.

Both males and females are wingless in the larval stages. The males always remain wingless. The females have four membranous wings when full grown.

**Food Plants:** It is known to feed on Kale, Cauliflower and Sweet Clover (*Melilotus alba*) as well as on Cabbage and Onions.

**Remedies:** The only remedy for them tried on cabbage was kerosene emulsion one part stock solution to ten parts water. This did not give as satisfactory results as desired because of the difficulty of getting the emulsion on all parts of the cabbage leaves.

A better plan would be to thoroughly spray the onions with kerosene emulsion, and not attempt to spray the cabbage, as the damage to them is small. This pest can not be killed with poisons to an advantage. Dr. Lintner recommends the use of Pyrethrum on cabbage.

**Enemies.** No parasites have been obtained from the onion thrips, and it has but few enemies that feed upon it. Indications of a fungous disease were found near Queens, N. Y., but the material was not preserved in condition that would permit its character to be positively determined.

## THE HARLEQUIN CABBAGE BUG.

*Murgantia histrionica*, HAHN.

(Ord. HEMIPTERA; Subord. Heteroptera; Fam. Pentatomidæ.)

This insect, although a Southern cabbage pest, is mentioned because Dr. Lintner predicted as early as 1882 that it would migrate to the north and become a cabbage pest in New York State, at least in the southern tier of counties. On September 25 several adult and larval forms were found feeding on radishes near Jamaica, N. Y. Mr. Lowe reported seeing it previous to this date near New Lots Road, Long Island. It injures cabbage by puncturing the leaves similar to the way in which the "Squash-Bug" injures the squash vine.

The adult bug is about three-eighths of an inch long and nearly one-fourth of an inch wide. The head is black, with two small yellowish-white lines between the eyes. The thorax is orange

colored, with a black irregular ring, which in some specimens incloses, and in others only partially incloses, an orange spot. The scutel, which is triangular, is black, with two yellowish-white spots at the basal angles and an orange cross in the center. The coriaceous or thickened portions of the wings are orange-red, with two oblique bars or double black spots on each; the tips are black.

The immature forms of the bug are marked similar to the adult, but have no wings.

As the principal remedy that has been recommended is hand-picking, it will be best for the Long Island farmer to make an effort to destroy them before they get a foothold.

### THE ZEBRA CATERPILLAR.

(*Mamestra picta*, HARRIS.)

(Order, LEPIDOPTERA: Fam. NOCTUIDÆ.)

Though rarely occurring in injurious numbers this pest some times attacks late cabbage and rutabagas. None were observed on cabbage and but few on rutabagas in any locality on Long Island the past fall.

It is easily distinguished by its velvety black color, tawny red head and legs, and two yellow lines along each side of the body, between which are many irregular white zebra-like lines. When full grown it is two inches long. It is three brooded and passes the winter in the pupa state. It feeds indiscriminately on quite a number of plants.

### THE CABBAGE PIONEER.

(*Pionea rimosalis*, GUEN.)

Although this pest was not noticed on Long Island the past season attention is called to it from the fact that it is a severe pest at times in localities where cabbage is raised. It is especially injurious because of its habit of boring into the heads. It is a small purplish brown caterpillar about one-half inch long, transversely banded with two or three white lines to each segment. It pupates at the surface of the ground in a light oval cocoon.

## THE SOUTHERN CABBAGE BUTTERFLY.

*(Pieris protidice, Bd.)*

This is the native cabbage butterfly. Its habits are similar to the imported cabbage butterfly. The butterflies have more black marks on the wings than the imported species. No specimens of this pest were noted the past fall on Long Island. The three last-named insects should be treated with the same remedies as the imported cabbage butterfly.

## II. NOTES ON THE STALK BORER.

*(Gortyna nitela, GUENEE.)*

During the fall numerous complaints were received with regard to the injury caused to corn by the "Stalk Borer." As it is its nature to bore into the stalk it is a difficult matter to apply efficient remedies. It hibernates in the moth stage.

One field of corn was observed which had the first three or four rows riddled by this pest. These rows were alongside a fence that has been allowed to grow up to weeds and underbrush. Burning such neglected corners where possible, late in the fall, or early in the spring would destroy quite a number of adult insects which seek such places to pass the winter.

## III. INSECTICIDES.

Throughout this report reference is made to the use of different remedies without giving in all cases explicit formulæ for making the same. For convenience the formulæ of the principal insecticides are grouped together. It should be remembered that these insecticides are not controlled by letters patent. Patent insecticides are fast reaching the level of patent medicine. Each is warranted to kill all insects and plant diseases. A few contain the principal ingredients of the unpatented insecticides in small quantities.

Insecticides are of two kinds or classes — first, those which kill by poisoning, and second, those which kill by contact, killing either by irritation or by smothering. It is necessary that the

insects eat the poisons before they can be injured by them, hence the first class of insecticides can not be used for all insects. The second class may be used on all insects but is far from practical in many cases.

The unpatented remedies of the first class are: "Paris green," Arsenite of copper, "London purple," Arsenite of lime, and "Gypsine" or Arsenate of lead. These are sometimes spoken of as the "Arsenites." They can be used in dry powder form or with water. When used in powder form they should be mixed with flour, road-dust, or land plaster, at the rate of one part of the poison to 15 or 20 parts of flour or plaster.

*Formula for water mixtures.*

Paris green or London purple .....	1 pound.
Lime unslaked .....	16 pounds.
Water (to make) .....	160 gallons.

Slack the lime and add to the Paris green with sufficient water to make 160 gallons.

*Formula for Gypsine.*

Lead acetate (sugar of lead) .....	11 ounces.
Arsenate of soda .....	4 ounces.
Water .....	160 gallons.

For cabbage insects it is best to use the arsenites in water. Milk of lime should be made from water-slaked lime. The lime not only prevents any injury to the foliage by the arsenite, but also aids in making the poison adhere to it.

"Gypsine" is one of the remedies used by Gypsy Moth Commission of Massachusetts. It needs to be tested more thoroughly before being recommended for general use. Its principal advantage lies in the fact that it does not injure the foliage.

Paris green ought to be purchased at 25 to 35 cents per pound, depending on the quantities purchased. London purple should not cost over 10 to 12 cents per pound. For making "Gypsine" sugar of lead can be purchased at 14 to 18 cents per pound, and arsenate of soda at 8 to 10 cents per pound.

The principal insecticides of the second class are kerosene washes, resin wash, bisulphide of carbon, tobacco and hot water

Kerosene washes are of two sorts, and the formulæ are usually given for stock solutions. These are, first:

*Kerosene and Soap Emulsion.*

Kerosene .....	2 gallons.
Soap .....	$\frac{1}{2}$ pound.
Water (soft) .....	1 gallon.

The soap should first be dissolved in the water by boiling. Remove from stove and while hot add the kerosene. The mixture should be violently agitated, either by churning or by being pumped back into itself. This should be continued for 5 or 10 minutes, or until the mixture has the consistency of cream. Where rain-water can not be had, a little lye or more soap should be used to "break" the water. Second:

*Emulsion of Kerosene and Sour Milk*

Kerosene .....	2 gallons.
Milk .....	1 gallon.

This simply requires churning without heat. Sweet milk may be used by adding a little vinegar. The second emulsion will not keep as long as the first.

These stock solutions should be diluted with 10 to 20 parts water when used, depending on the susceptibility of the foliage to injury from the emulsion and the kind of insects to be treated. The soap emulsion becomes hard by standing, and should be dissolved in a little hot water when wanted for use. Care should always be used not to have free oil in any of the emulsions.

*Resin wash.*

Resin .....	20 pounds.
Caustic soda.....	5 pounds.
Fish oil.....	2 $\frac{1}{2}$ pints.
Water to make.....	100 gallons.

The resin and caustic soda should be finely broken up to help in dissolving them. They should be put in an iron kettle with the fish oil and water enough added to cover the whole. The boiling should be continued from one to two hours or until the compound will mix with water without forming yellowish flakes.

Bisulphide of carbon has been partially described in article on cabbage aphis. It is a colorless liquid with an offensive smell. It is heavier than water and the fumes are heavier than air. If applied directly to plants it evaporates so rapidly that it may freeze them. Bisulphide of carbon can be purchased at eight cents per pound in barrel quantities or at 10 cents per pound in 50 pound cans.

Tobacco may be used as a powder, as a liquid or in the form of fumes. As previously stated it is a more active insecticide than most of the "insect powders."

Hot water is a useful insecticide, on a small scale, when it can be applied directly to the insects.

Omitting a few special cases insects which feed on plants may be divided into two groups, based upon their method of feeding, viz., biting or gnawing insects and sucking or pumping insects. For the first group, or biting insects, only the first class of remedies are practical. For the second group or suctorial insects only the second class of insecticides can be used.

For a more complete description of insecticides, their preparation and use, farmers will find "The Farmer's Bulletin," No. 19, issued by the United States Department of Agriculture, a very practical work.

Fig. 1.<sup>1</sup> Photomicrograph of the egg of *Pieris rapæ*, showing the larva in the act of gnawing out. Magnified, about 45 diameters.

Fig. 1. Same as Fig. 1<sup>1</sup>, after hatching. Magnified approximately, 30 diameters.

Fig. 2. Portion of cabbage leaf showing larva of *Pieris rapæ* covered with cocoons of a parasite (*Apanteles glomeratus*). Natural size. Diagrammatic.

Fig. 3. Photomicrograph of the egg of *Plusia brassicæ*. Magnified approximately, 20 diameters.

Fig. 4. Female of *Plusia brassicæ*. Natural size.

Fig. 4<sup>1</sup>. Male of *Plusia brassicæ*. Natural size.

Fig. 5. Two sizes of larva of *Plusia brassicæ* on portion of cabbage leaf. Natural size.

Fig. 6. Portion of cabbage leaf showing larva of *Plutella cruciferarum* feeding. Slightly magnified.

Fig. 6<sup>1</sup>. Cocoon of *Plutella cruciferarum*.

Figures 1, 1<sup>1</sup>, 3, 4, 4<sup>1</sup>, 5, 6 and 6<sup>1</sup> were photographed from nature by Mr. L. V. Hallock, of Queens, N. Y., from material furnished by the writer.

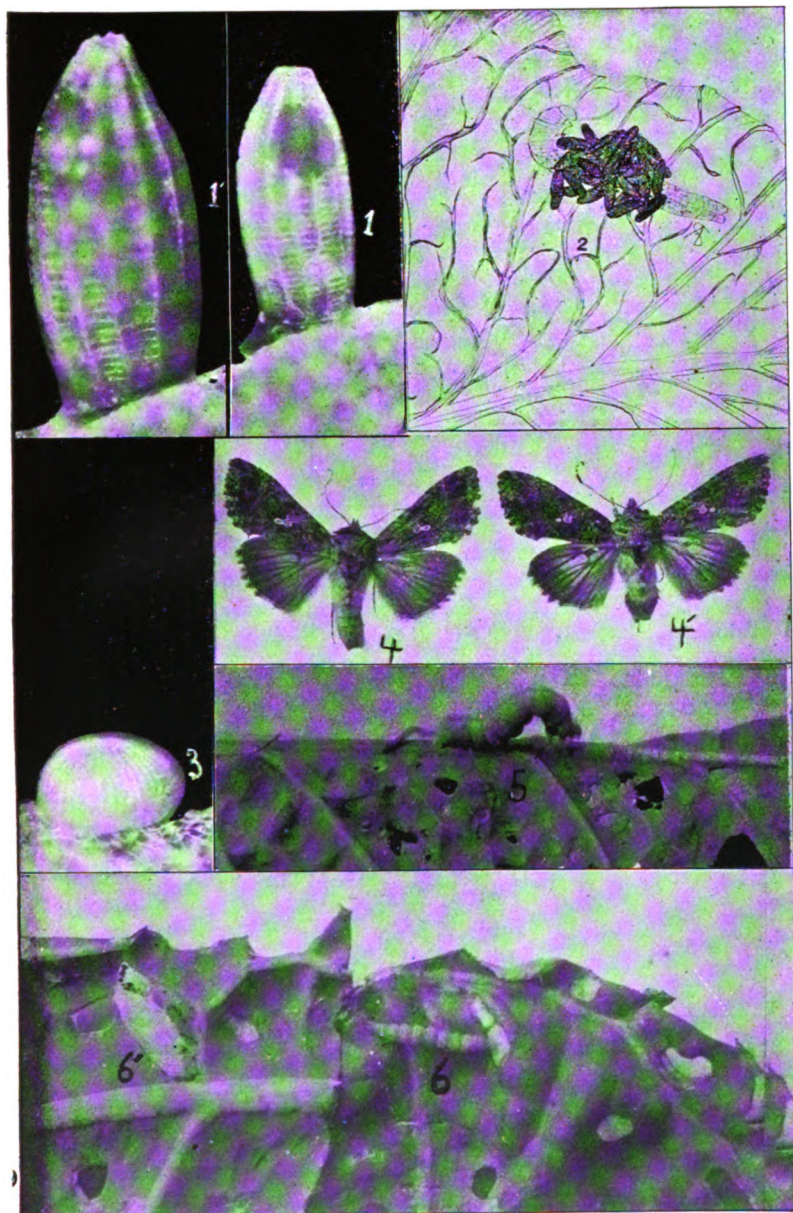
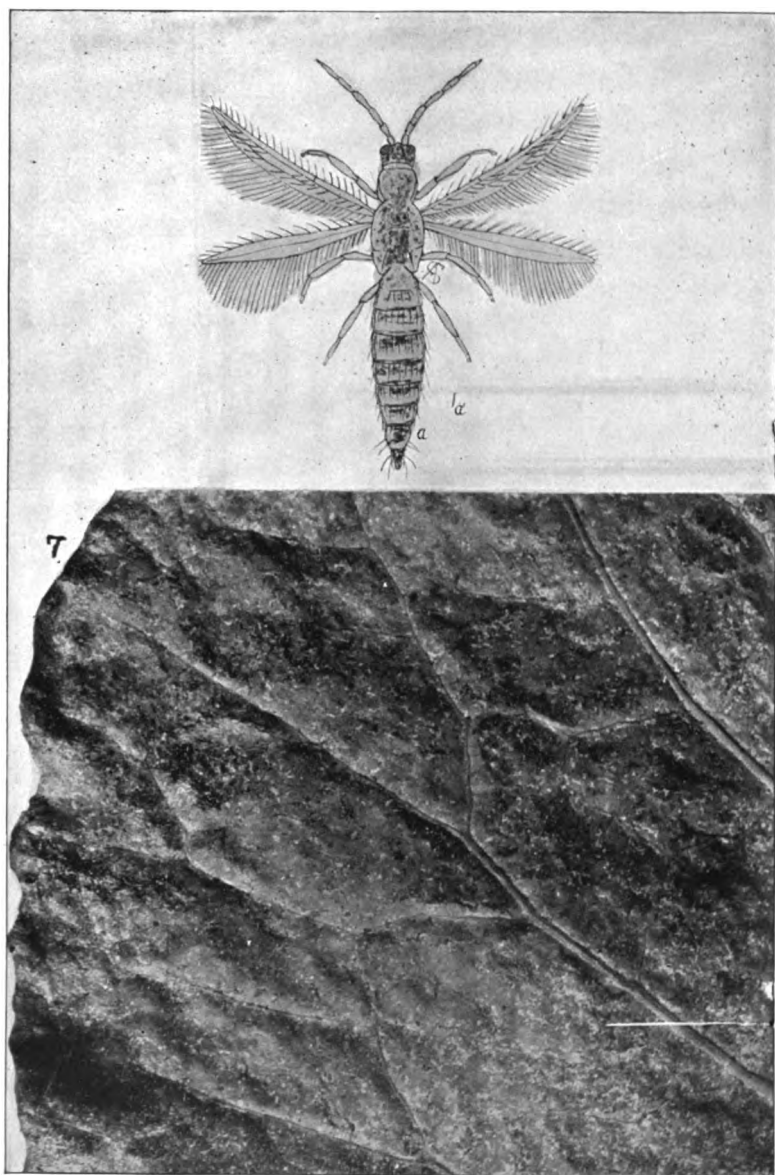






Fig. a. *Thrips alii*. Magnified, about 45 diameters; drawn from specimen mounted in balsam and slightly pressed out. The antennæ are a trifle too long and in life the last tarsal joint is more bladder shaped. Slightly diagrammatic. The line at a<sup>1</sup> represents the natural size of the specimen.

Fig. 7. Photograph of cabbage leaf showing work of *Thrips alii*. Slightly magnified.





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# METEOROLOGY FOR 1894.

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# WIND RECORD FOR 1894.

DATE.	JANUARY.				FEBRUARY.				MARCH.				APRIL.			
	Northerly N. W. to N. E.	Easterly N. E. to S. E.	Southerly S. E. to S. W.	Westerly S. W. to N. W.	Northerly N. W. to N. E.	Easterly N. E. to S. E.	Southerly S. E. to S. W.	Westerly S. W. to N. W.	Northerly N. W. to N. E.	Easterly N. E. to S. E.	Southerly S. E. to S. W.	Westerly S. W. to N. W.	Northerly N. W. to N. E.	Easterly N. E. to S. E.	Southerly S. E. to S. W.	Westerly S. W. to N. W.
1	Hrs.	Hrs.	Hrs.	Hrs.	Hrs.	Hrs.	Hrs.	Hrs.	Hrs.	Hrs.	Hrs.	Hrs.	Hrs.	Hrs.	Hrs.	Hrs.
2	.....	.....	4.0	4.0	.....	.....	6.0	8.0	.....	.....	6.0	.....	.....	11.0	.....	.....
3	.....	.....	15.0	.....	.....	.....	4.0	18.0	.....	.....	.....	.....	.....	.....	.....	19.0
4	.....	.....	17.0	.....	10.0	.....	.....	12.0	.....	.....	15.0	.....	.....	.....	.....	13.0
5	.....	.....	.....	8.0	12.0	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	7.0
6	.....	.....	.....	.....	.....	.....	12.0	1.0	.....	.....	.....	.....	.....	.....	.....	.....
7	.....	.....	1.0	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
8	.....	.....	.....	18.0	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
9	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
10	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
11	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
12	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
13	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
14	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
15	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
16	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
17	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
18	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
19	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
20	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
21	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
22	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
23	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
24	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
25	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
26	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
27	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
28	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
29	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
30	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
31	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Total hours of movement.....	52.0	4.0	231.0	203.0	68.0	50.0	143.0	392.0	32.0	32.0	191.0	267.0	53.0	34.0	149.0	215.0
Per cent. of time in each direction.....	10.7	9	47.2	41.8	14.5	10.6	80.9	44.5	4.4	4.4	38.8	52.9	11.7	7.5	33.0	

WIND RECORD FOR 1894 — (Continued).

DATE.	MAY.				JUNE.				JULY.				AUGUST.			
	Northerly	Easterly	S. E. to S. W.	Westerly	N. W. to N. E.	Easterly	N. E. to S. E.	Southerly	S. E. to S. W.	Westerly	N. W. to N. E.	Easterly	N. E. to S. E.	Southerly	S. E. to S. W.	Westerly
1	Hrs.	Hrs.	Hrs.	Hrs.	Hrs.	Hrs.	Hrs.	Hrs.	Hrs.	Hrs.	Hrs.	Hrs.	Hrs.	Hrs.	Hrs.	Hrs.
2	1.0	1.0	2.0	4.0	2.0	2.0	4.0	2.0	3.0	3.0	1.0	1.0	3.0	1.0	2.0	2.0
3	2.0	1.0	2.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
4	2.0	1.0	2.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
5	2.0	1.0	2.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
6	2.0	1.0	2.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
7	2.0	1.0	2.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
8	2.0	1.0	2.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
9	2.0	1.0	2.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
10	2.0	1.0	2.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
11	2.0	1.0	2.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
12	2.0	1.0	2.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
13	2.0	1.0	2.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
14	2.0	1.0	2.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
15	2.0	1.0	2.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
16	2.0	1.0	2.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
17	2.0	1.0	2.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
18	2.0	1.0	2.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
19	2.0	1.0	2.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
20	2.0	1.0	2.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
21	2.0	1.0	2.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
22	2.0	1.0	2.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
23	2.0	1.0	2.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
24	2.0	1.0	2.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
25	2.0	1.0	2.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
26	2.0	1.0	2.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
27	2.0	1.0	2.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
28	2.0	1.0	2.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
29	2.0	1.0	2.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
30	2.0	1.0	2.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
31	2.0	1.0	2.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Total hours of movement.....	98.0	14.0	189.0	104.0	84.0	6.0	183.0	294.0	198.0	18.0	13.0	183.0	142.0	198.0	173.0	123.0
Per cent. of time in each direction.....	24.1	3.4	46.6	25.7	8.5	1.5	38.5	51.3	23.6	2.8	2.8	42.3	31.1	27.3	33.6	28.7



SUMMARY OF DIRECTION OF WIND FOR 1894.

	Northerly, N. W. to N. E. ° 30-60; N. E. to E. 60-90	Easterly, N. E. to E. 60-90	Southerly, S. E. to S. W.	Westerly, S. W. to N. W.
January .....	52	4	231	203
February .....	68	50	143	209
March .....	23	23	191	257
April .....	53	34	149	215
May .....	98	14	189	104
June .....	34	6	153	304
July .....	108	13	193	142
August .....	136	34	178	123
September .....	36	13	230	92
October .....	35	21	296	146
November .....	53	2	335	167
December .....	23	33	302	199
Total hours of movement.....	703	246	2,609	2,060
Per cent. of time in each direction.....	12.5	4.4	46.4	36.7
Average for past eight years.....	755	405	1,731	2,714
Per cent. of time in each direction.....	13.4	7.3	31.6	47.7

## SUNSHINE RECORD FOR 1894 BY NEGRETTE AND ZAMBRA INSTRUMENTS.

DATE.	JANUARY.					FEBRUARY.						
	Before 9 A.M.	9 to 12.	12 to 3.	After 3 P.M.	Total hours.	Hours sunrise to sun- set.	Before 9 A.M.	9 to 12.	12 to 3.	After 3 P.M.	Total hours.	Hours sunrise to sun- set.
	Hrs. m.	Hrs. m.	Hrs. m.	Hrs. m.	Hrs. m.	Hrs. m.	Hrs. m.	Hrs. m.	Hrs. m.	Hrs. m.	Hrs. m.	Hrs. m.
1.....	0 00	2 10	2 30	1 00	5 40	9 03	1 15	3 40	2 10	1 00	7 30	10 00
2.....	0 00	1 10	1 00	0 00	2 10	9 09	1 30	3 00	2 50	1 30	8 15	10 04
3.....	0 00	0 00	1 40	0 30	3 10	9 11	0 00	0 00	0 00	0 00	0 00	10 07
4.....	0 00	1 00	2 00	0 00	3 00	9 13	0 00	0 00	0 00	0 00	0 00	10 09
5.....	0 00	0 00	0 00	0 00	0 00	9 14	1 35	3 00	3 00	1 40	9 45	10 12
6.....	0 00	0 00	0 00	0 00	0 00	9 15	1 10	3 00	1 50	1 00	6 00	10 14
7.....	0 40	2 10	2 20	0 45	6 25	9 16	1 30	3 00	2 10	1 30	7 50	10 17
8.....	0 00	1 10	1 30	0 00	3 30	9 17	0 00	0 00	1 10	0 00	1 10	10 21
9.....	0 00	1 00	1 00	0 00	3 00	9 19	0 00	0 00	1 10	0 00	3 10	10 24
10.....	0 00	1 00	1 00	0 00	3 00	9 22	0 00	0 00	0 00	0 00	0 00	10 27
11.....	0 00	1 00	1 00	0 00	3 00	9 23	0 00	0 00	0 00	0 00	0 00	10 29
12.....	0 00	1 00	1 00	0 00	3 00	9 24	0 00	0 00	0 00	0 00	0 00	10 31
13.....	0 00	0 00	1 00	0 00	2 00	9 26	0 00	0 00	0 00	0 00	0 00	10 35
14.....	1 30	3 00	3 00	1 10	8 30	9 27	1 10	3 00	3 10	1 50	10 10	10 37
15.....	0 00	0 00	1 00	0 00	2 00	9 28	0 00	0 00	0 00	0 00	0 00	10 41
16.....	0 00	0 00	1 00	0 00	2 00	9 29	0 00	0 00	0 00	0 00	0 00	10 43
17.....	0 00	1 10	1 00	0 40	3 50	9 30	1 40	3 00	3 00	1 50	9 30	10 45
18.....	0 00	1 00	1 00	0 00	3 00	9 33	1 40	3 00	2 40	1 30	8 40	10 46
19.....	0 00	1 00	1 00	0 00	3 00	9 35	1 30	3 00	3 00	1 35	8 55	10 52
20.....	1 10	3 30	1 00	1 10	6 40	9 36	1 30	3 00	3 00	1 35	9 30	10 55
21.....	1 10	3 30	1 00	1 10	6 50	9 38	1 45	3 00	3 00	2 00	9 45	10 58
22.....	1 10	3 30	1 00	1 10	6 50	9 41	1 20	3 00	3 00	2 00	10 00	11 01
23.....	0 00	0 00	1 00	0 40	4 40	9 43	2 00	3 00	3 00	2 00	10 05	11 04
24.....	0 00	1 20	1 00	1 10	5 30	9 46	2 10	3 00	3 00	2 00	10 10	11 06
25.....	1 10	3 30	1 00	1 10	7 10	9 49	2 30	3 00	3 00	2 00	10 15	11 08
26.....	0 00	0 00	1 00	0 00	1 00	9 51	1 10	3 00	3 00	1 00	9 10	11 11
27.....	0 00	0 00	0 00	0 00	0 00	9 55	0 00	0 00	0 00	0 00	0 00	11 13
28.....	0 00	0 00	0 00	0 00	0 00	9 56	0 00	0 00	0 00	0 00	0 00	11 13
29.....	0 00	0 00	0 00	0 00	0 00	9 58	0 00	0 00	0 00	0 00	0 00	11 13
30.....	0 00	0 00	0 00	0 00	0 00	9 59	0 00	0 00	0 00	0 00	0 00	11 13
31.....	1 25	4 45	4 10	1 10	11 45	9 59	25	40	35	55	175	506
Total hours.....	10 15	45	40	15	109	19	38	60	50	28	175	506
Per cent. of possible.....	20.9	43.3	25.3	27.1	87.1	894	49.5	73.3	70.9	40.8	59.4	894

SUNSHINE RECORD — (Continued).

DATE.	MARCH.						APRIL.					
	Before 9 A. M.	9 to 12	12 to 3	After 3 P. M.	Total hours.	Hours sunrise to sun- set.	Before 9 A. M.	9 to 12	12 to 3	After 3 P. M.	Total hours.	Hours sunrise to sun- set.
1.....	Hrs. m. 2 10 3	Hrs. m. 3 00 0	Hrs. m. 3 00 0	Hrs. m. 1 40 0	Hrs. m. 9 50 0	Hrs. m. 11 15 15	Hrs. m. 0 0 0	Hrs. m. 1 10 10	Hrs. m. 1 15 15	Hrs. m. 0 30 30	Hrs. m. 2 45 45	Hrs. m. 12 41 41
2.....	1 00 3	3 00 0	3 00 0	2 30 0	10 30 0	11 17 17	3 15 3	3 00 0	3 00 0	2 30 0	10 35 35	12 42 42
3.....	2 10 3	3 00 0	3 00 0	2 05 0	10 15 15	11 30 30	2 35 3	3 00 0	3 00 0	2 40 0	10 35 35	12 43 43
4.....	2 10 3	3 00 0	3 00 0	1 40 0	9 40 0	11 33 33	2 00 0	3 00 0	1 10 0	0 00 0	10 10 10	12 48 48
5.....	2 10 3	3 00 0	3 00 0	2 10 0	10 30 0	11 36 36	0 00 0	3 00 0	0 00 0	0 00 0	0 00 0	12 51 51
6.....	2 10 3	3 00 0	3 00 0	2 00 0	10 00 0	11 38 38	0 00 0	3 00 0	0 00 0	0 00 0	0 00 0	12 54 54
7.....	1 35 3	2 10 3	3 00 0	1 00 0	6 55 11	11 31 31	0 00 0	3 00 0	0 00 0	0 00 0	0 00 0	12 56 56
8.....	1 00 3	3 00 0	3 00 0	0 00 0	8 00 0	11 33 33	3 10 3	3 00 0	3 00 0	1 50 10	10 40 40	12 59 59
9.....	3 15 3	3 00 0	3 00 0	2 30 0	0 00 0	11 36 36	2 30 3	3 00 0	3 00 0	2 10 10	10 40 40	13 02 02
10.....	1 10 3	3 00 0	3 00 0	2 20 0	10 35 11	11 39 39	0 00 0	3 00 0	0 00 0	0 00 0	0 00 0	13 04 04
11.....	3 20 3	3 00 0	3 00 0	2 00 0	7 20 11	11 42 42	0 00 0	3 00 0	0 00 0	0 00 0	0 00 0	13 06 06
12.....	0 00 3	3 00 0	3 00 0	0 00 0	10 20 11	11 45 45	3 30 3	3 00 0	3 00 0	3 40 0	11 50 10	13 08 08
13.....	0 00 3	3 00 0	3 00 0	0 00 0	9 00 11	11 48 48	2 30 3	3 00 0	3 00 0	3 00 0	11 35 16	13 11 11
14.....	1 40 3	3 00 0	3 00 0	0 00 0	4 20 11	11 51 51	2 10 3	3 00 0	3 00 0	3 00 0	11 35 16	13 13 13
15.....	2 30 3	3 00 0	3 00 0	0 00 0	9 40 11	11 53 53	2 30 3	3 00 0	3 00 0	2 55 11	11 15 13	13 16 16
16.....	2 30 3	3 00 0	3 00 0	2 10 0	10 30 12	12 00 0	2 25 3	3 00 0	3 00 0	2 55 11	11 15 13	13 17 17
17.....	2 30 3	3 00 0	3 00 0	2 35 0	10 55 12	12 03 03	2 00 0	3 00 0	2 40 0	2 40 0	10 7 6	13 19 19
18.....	1 30 3	3 00 0	3 00 0	2 30 0	9 20 12	12 05 05	0 00 0	3 00 0	2 30 0	2 30 0	9 50 13	13 20 20
19.....	2 30 3	3 00 0	3 00 0	2 15 0	9 45 12	12 06 06	0 00 0	3 00 0	2 15 0	1 15 4	8 30 13	13 23 23
20.....	0 00 3	3 00 0	3 00 0	2 00 0	9 00 12	12 11 11	0 00 0	3 00 0	2 00 0	1 15 4	8 30 13	13 25 25
21.....	0 00 3	3 00 0	3 00 0	0 00 0	8 00 12	12 14 14	0 00 0	3 00 0	0 00 0	0 00 0	8 00 13	13 28 28
22.....	0 00 3	3 00 0	3 00 0	0 00 0	7 00 12	12 16 16	0 00 0	3 00 0	0 00 0	0 00 0	7 00 13	13 30 30
23.....	0 00 3	3 00 0	3 00 0	1 15 0	6 55 12	12 19 19	0 00 0	3 00 0	0 00 0	0 00 0	6 55 13	13 33 33
24.....	0 00 3	3 00 0	3 00 0	0 00 0	4 10 12	12 19 19	3 45 3	3 00 0	3 00 0	3 00 0	11 45 13	13 35 35
25.....	0 00 3	3 00 0	3 00 0	0 00 0	4 00 12	12 22 22	3 30 3	3 00 0	3 00 0	3 00 0	11 45 13	13 38 38
26.....	0 00 3	3 00 0	3 00 0	0 00 0	4 35 12	12 26 26	3 30 3	3 00 0	3 00 0	3 40 0	11 30 13	13 43 43
27.....	0 00 3	3 00 0	3 00 0	2 40 0	4 30 12	12 27 27	3 00 0	3 00 0	3 00 0	3 40 0	11 30 13	13 45 45
28.....	1 15 3	2 05 12	3 00 0	0 00 0	4 30 12	12 30 30	0 00 0	3 00 0	3 00 0	3 40 0	11 30 13	13 48 48
29.....	0 00 3	3 00 0	3 00 0	1 10 0	3 50 12	12 33 33	0 00 0	3 00 0	0 00 0	0 00 0	11 20 13	13 50 50
30.....	1 10 3	3 00 0	3 00 0	1 30 0	3 50 12	12 33 33	3 50 3	3 00 0	3 00 0	3 40 0	11 20 13	13 51 51
31.....	1 10 3	3 00 0	3 00 0	0 00 0	4 50 12	12 36 36	3 45 3	3 00 0	3 00 0	3 40 0	11 25 13	13 54 54
Total hours.....	36 05	56 45	54 50	36 45	184 25	370 10	36 30	50 10	55 10	41 35	183 35	401 13
Per cent. of possible.....	41.3	61.0	58.9	57.9	49.8	.....	53.0	55.5	61.2	57.4	45.4	.....

# REPORT OF THE METEOROLOGIST OF THE

**SUNSHINE RECORD — (Concluded).**

DATE.	MAY.					JUNE.				
	Before 9 A. M.		12 to 3.		After 3 P. M.		Total hours.		Hours surpluse to sub-sect.	
	Hrs.	Mn.	Hrs.	Mn.	Hrs.	Mn.	Hrs.	Mn.	Hrs.	Mn.
1.....	37	05	43	45	41	35	147	40	433	39
2.....	37	05	43	45	41	35	147	40	433	39
3.....	37	05	43	45	41	35	147	40	433	39
4.....	37	05	43	45	41	35	147	40	433	39
5.....	37	05	43	45	41	35	147	40	433	39
6.....	37	05	43	45	41	35	147	40	433	39
7.....	37	05	43	45	41	35	147	40	433	39
8.....	37	05	43	45	41	35	147	40	433	39
9.....	37	05	43	45	41	35	147	40	433	39
10.....	37	05	43	45	41	35	147	40	433	39
11.....	37	05	43	45	41	35	147	40	433	39
12.....	37	05	43	45	41	35	147	40	433	39
13.....	37	05	43	45	41	35	147	40	433	39
14.....	37	05	43	45	41	35	147	40	433	39
15.....	37	05	43	45	41	35	147	40	433	39
16.....	37	05	43	45	41	35	147	40	433	39
17.....	37	05	43	45	41	35	147	40	433	39
18.....	37	05	43	45	41	35	147	40	433	39
19.....	37	05	43	45	41	35	147	40	433	39
20.....	37	05	43	45	41	35	147	40	433	39
21.....	37	05	43	45	41	35	147	40	433	39
22.....	37	05	43	45	41	35	147	40	433	39
23.....	37	05	43	45	41	35	147	40	433	39
24.....	37	05	43	45	41	35	147	40	433	39
25.....	37	05	43	45	41	35	147	40	433	39
26.....	37	05	43	45	41	35	147	40	433	39
27.....	37	05	43	45	41	35	147	40	433	39
28.....	37	05	43	45	41	35	147	40	433	39
29.....	37	05	43	45	41	35	147	40	433	39
30.....	37	05	43	45	41	35	147	40	433	39
Total hours.....	37	05	43	45	41	35	147	40	433	39
per cent. of possible.....	37.4		48.3		38.6		33.1		32.5	

READING OF MAXIMUM AND MINIMUM THERMOMETERS AT 7 A. M.

1894.	JANUARY.		FEBRUARY.		MARCH.		APRIL.		MAY.		JUNE.		JULY.		AUGUST.		SEPTEMBER.		OCTOBER.		NOVEMBER.		DECEMBER.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	
1.....	30.0	22.0	33.0	17.0	43.0	31.0	42.0	31.4	75.0	43.0	56.0	45.0	90.0	64.8	76.0	53.0	74.0	52.5	76.5	49.0	55.0	45.0	34.5	25.0
2.....	32.0	20.0	34.0	14.0	50.0	32.0	33.0	30.0	85.4	53.4	57.0	47.0	92.0	64.0	82.0	61.5	79.0	56.5	66.5	45.5	51.0	36.5	28.0	
3.....	45.0	31.0	34.0	13.0	44.7	29.0	36.0	26.0	74.8	48.5	70.4	54.0	93.0	66.7	83.0	61.0	89.0	60.5	67.0	49.0	65.0	36.0	27.0	
4.....	44.0	34.8	36.6	15.0	44.5	33.0	37.0	40.0	66.0	49.0	59.6	49.0	84.3	61.0	76.5	53.5	80.0	60.5	68.5	54.0	54.5	36.5	23.0	
5.....	59.0	36.0	34.8	12.8	61.0	35.0	40.0	44.0	64.8	42.0	59.5	43.7	78.0	61.0	71.5	51.5	83.0	66.0	68.5	46.5	52.0	33.0	24.0	
6.....	39.5	23.0	21.0	06.0	53.8	34.0	42.0	30.0	75.0	42.5	63.0	39.0	75.3	52.0	78.0	54.0	83.0	60.0	57.0	48.5	43.0	32.0	24.0	
7.....	38.0	26.0	25.6	16.5	61.0	34.6	41.0	36.5	71.0	45.0	59.0	43.0	87.0	57.0	82.7	61.5	84.0	67.7	58.0	48.0	57.0	36.0	28.5	
8.....	35.0	16.0	40.0	09.0	46.3	26.0	39.0	25.0	60.7	40.0	60.4	40.0	86.0	54.0	81.7	62.0	81.0	61.0	61.5	45.0	56.5	37.0	29.0	
9.....	38.5	17.8	45.0	11.0	59.0	26.0	40.0	24.0	60.4	39.9	71.2	52.7	86.5	54.0	81.7	62.0	82.0	67.0	60.0	40.5	30.0	36.0	30.0	
10.....	39.0	23.0	40.0	08.0	53.0	37.0	41.0	39.0	65.7	40.3	68.2	55.0	86.0	59.3	70.3	60.0	75.5	60.0	53.0	42.0	40.0	36.0	30.0	
11.....	43.6	15.0	47.0	09.5	57.0	30.5	42.3	19.3	63.3	42.0	57.0	58.2	90.5	67.7	70.5	58.3	83.0	65.0	52.0	40.5	33.5	24.0	37.0	
12.....	32.0	12.0	23.0	09.5	54.0	30.0	48.0	33.0	63.0	32.6	77.5	53.5	92.0	65.0	77.0	58.5	80.5	63.0	60.0	39.5	39.0	25.0	35.0	
13.....	42.0	22.4	25.0	14.8	47.0	24.0	61.0	34.0	68.0	47.3	83.0	65.0	81.0	58.0	79.0	60.0	85.0	63.0	47.0	35.0	39.0	20.5	35.0	
14.....	35.8	38.0	35.4	05.5	54.0	34.0	61.0	37.0	74.0	46.0	88.0	63.5	90.7	65.5	83.0	63.0	80.5	63.0	65.0	40.0	53.0	30.5	32.3	
15.....	44.0	30.0	38.0	10.0	73.0	43.0	68.0	39.0	77.0	46.0	88.0	65.0	94.5	68.0	80.0	58.0	85.0	63.0	47.0	35.0	39.0	20.5	32.5	
16.....	41.0	9.0	42.6	15.0	65.0	30.0	68.5	45.0	70.0	46.0	88.0	65.0	94.5	68.0	80.0	58.0	85.0	63.0	47.0	35.0	39.0	20.5	32.5	
17.....	38.0	19.0	47.6	19.0	48.0	31.8	70.0	54.0	70.0	47.0	80.0	63.0	95.5	63.5	83.0	64.0	86.0	68.0	72.5	41.5	33.5	15.5	38.5	
18.....	43.0	33.0	47.6	19.0	63.5	37.0	71.3	44.4	64.0	46.3	74.8	64.0	97.0	61.5	79.0	64.0	86.0	68.0	72.5	41.5	33.5	15.5	38.5	
19.....	45.0	31.0	45.5	14.0	46.5	35.0	60.0	43.0	67.0	43.5	91.6	60.0	75.0	59.5	66.0	49.0	82.0	64.0	65.5	49.0	55.0	30.0	38.5	
20.....	48.7	18.0	36.5	1.0	47.5	35.0	60.0	43.0	67.0	43.5	91.6	60.0	75.0	59.5	66.0	49.0	82.0	64.0	65.5	49.0	55.0	30.0	38.5	
21.....	45.0	34.0	38.0	00.0	47.4	32.0	60.0	43.0	67.0	43.5	91.6	60.0	75.0	59.5	66.0	49.0	82.0	64.0	65.5	49.0	55.0	30.0	38.5	
22.....	37.0	24.0	28.0	01.0	46.5	30.0	58.0	40.4	55.0	43.0	88.0	63.0	90.7	65.5	83.0	64.0	86.0	68.0	72.5	41.5	33.5	15.5	38.5	
23.....	41.0	16.0	12.8	1.0	46.0	17.0	43.8	36.0	55.0	46.0	91.0	69.0	75.0	58.5	68.0	61.3	81.0	61.0	60.5	53.5	45.0	37.0	14.0	
24.....	48.0	35.0	38.0	01.7	41.5	36.0	58.0	40.4	55.0	43.0	88.0	63.0	90.7	65.5	83.0	64.0	86.0	68.0	72.5	41.5	33.5	15.5	38.5	
25.....	18.6	13.0	21.0	8.0	39.0	15.0	43.8	36.0	55.0	46.0	91.0	69.0	75.0	58.5	68.0	61.3	81.0	61.0	60.5	53.5	45.0	37.0	14.0	
26.....	27.0	17.0	26.0	12.0	33.0	15.0	43.8	36.0	55.0	46.0	91.0	69.0	75.0	58.5	68.0	61.3	81.0	61.0	60.5	53.5	45.0	37.0	14.0	
27.....	31.5	22.0	27.0	13.0	35.6	20.5	51.3	39.6	58.0	40.0	81.6	66.0	78.5	63.0	73.5	57.0	75.5	53.0	64.0	41.5	36.0	12.0	14.5	
28.....	35.0	25.0	30.0	13.0	35.6	20.5	51.3	39.6	58.0	40.0	81.6	66.0	78.5	63.0	73.5	57.0	75.5	53.0	64.0	41.5	36.0	12.0	14.5	
29.....	35.0	25.0	30.0	13.0	35.6	20.5	51.3	39.6	58.0	40.0	81.6	66.0	78.5	63.0	73.5	57.0	75.5	53.0	64.0	41.5	36.0	12.0	14.5	
30.....	37.0	24.0	34.0	13.0	35.6	20.5	51.3	39.6	58.0	40.0	81.6	66.0	78.5	63.0	73.5	57.0	75.5	53.0	64.0	41.5	36.0	12.0	14.5	
Aver.	37.0	28.3	32.9	12.9	46.3	30.4	52.7	35.4	65.9	45.1	77.5	58.1	87.5	60.9	76.3	55.3	76.8	53.5	61.4	43.9	43.4	28.6	24.5	

1894	JANUARY.			FEBRUARY.			MARCH.			APRIL.			MAY.			JUNE.		
	7 A. M.	12 M.	6 P. M.	7 A. M.	12 M.	6 P. M.	7 A. M.	12 M.	6 P. M.	7 A. M.	12 M.	6 P. M.	7 A. M.	12 M.	6 P. M.	7 A. M.	12 M.	6 P. M.
1	34.0	39.0	22.0	17.8	33.0	19.0	31.0	46.0	40.0	40.0	38.0	29.0	54.0	79.0	76.0	47.0	51.0	51.2
2	30.4	43.6	38.0	14.0	35.0	20.0	38.0	42.5	36.5	31.0	26.5	25.5	68.0	72.0	63.0	47.2	50.0	54.0
3	36.5	41.0	36.0	33.0	35.0	32.0	30.0	38.0	38.0	40.0	44.0	42.0	49.6	65.0	65.0	54.6	68.0	68.0
4	39.0	55.0	40.8	15.0	18.0	-8.0	34.5	52.8	43.8	47.0	50.6	41.0	59.0	60.0	60.8	56.0	58.7	56.0
5	36.0	39.0	28.0	-6.0	19.0	14.0	43.5	52.0	51.0	40.0	37.0	32.0	50.0	68.0	72.4	49.0	50.8	48.6
6	36.0	28.0	28.0	16.5	29.0	31.0	46.3	55.4	46.0	39.0	35.0	30.0	67.4	73.0	71.0	45.0	55.0	53.0
7	31.3	39.0	25.0	29.8	37.0	33.0	42.0	33.4	28.0	32.8	32.0	35.0	56.0	67.0	64.3	50.5	58.0	50.0
8	32.0	36.0	26.0	36.0	42.0	35.0	39.0	33.0	27.0	40.0	31.0	29.0	57.3	65.6	60.4	53.0	68.0	65.4
9	18.8	25.4	32.0	32.8	35.3	37.0	36.3	37.0	31.0	41.0	39.0	34.0	43.0	58.0	56.0	59.5	76.0	70.9
10	34.0	31.0	28.0	39.0	37.0	34.3	51.0	51.0	37.0	40.0	33.0	38.5	47.0	66.2	70.0	72.0	84.0	80.0
11	37.0	39.0	35.0	26.0	27.5	21.0	51.0	44.6	31.0	36.0	40.4	39.0	52.0	63.0	61.0	75.0	85.0	77.0
12	16.0	21.0	15.0	10.0	14.0	14.0	43.0	39.0	35.7	34.8	44.2	44.0	50.0	67.8	73.8	64.0	82.0	76.5
13	11.0	23.0	26.0	11.3	21.0	15.0	45.0	47.0	29.0	36.6	51.6	50.6	54.0	67.0	66.0	62.5	73.0	71.0
14	28.0	45.0	37.0	15.0	23.0	18.0	29.3	28.5	24.6	46.0	59.0	54.0	49.0	51.7	50.0	60.5	77.8	77.4
15	39.0	40.6	41.0	21.0	23.0	18.6	26.0	30.0	39.0	37.0	62.0	59.0	45.0	58.0	58.0	66.0	80.0	80.0
16	35.0	33.0	30.0	14.0	-8.0	-1.5	40.3	40.3	30.4	49.0	68.0	60.2	47.4	67.0	60.0	67.0	87.0	84.0
17	39.0	36.5	34.0	10.0	27.5	31.6	49.0	48.0	50.0	45.0	66.0	59.0	54.0	66.8	70.0	73.0	85.6	78.4
18	30.3	38.4	36.0	43.0	39.0	29.0	64.0	64.4	59.6	55.0	60.0	65.0	62.0	73.5	58.7	71.6	85.7	70.6
19	30.7	31.0	24.0	20.0	42.4	35.0	57.0	45.0	31.0	58.0	65.0	57.0	47.0	47.0	46.8	68.0	77.0	70.0
20	23.5	34.4	38.7	21.4	31.0	19.0	44.3	45.3	41.0	47.0	58.6	49.0	68.0	70.0	62.4	65.0	70.0	70.5
21	36.0	37.0	38.0	14.0	19.6	-1.5	49.6	57.4	37.0	47.0	44.0	46.5	48.0	51.6	53.0	66.0	79.0	80.0
22	36.0	34.8	26.6	-0.0	34.0	23.0	37.4	35.6	44.0	40.7	50.0	57.0	49.0	56.0	56.0	67.0	86.0	87.0
23	36.0	33.0	27.0	12.0	-9.0	-5.5	42.5	35.4	30.0	43.6	47.0	46.0	52.2	56.0	55.0	77.8	87.0	82.0
24	39.0	43.3	33.0	-4.0	-0.0	-3.0	41.0	44.3	31.8	41.3	57.0	53.0	49.0	54.0	55.0	71.0	85.6	77.3
25	16.0	18.0	14.0	-8.0	17.0	20.0	34.0	29.0	19.0	42.2	64.0	62.0	53.0	57.0	55.0	73.0	82.8	77.0
26	13.0	23.0	30.0	-9.0	25.4	19.0	24.0	20.0	18.3	45.7	67.3	65.7	50.0	65.2	60.7	71.6	82.3	63.0
27	18.0	36.6	24.2	12.0	31.0	33.3	23.7	22.0	22.0	52.0	58.0	53.0	57.0	75.0	72.0	70.0	77.0	73.7
28	22.2	36.0	23.0	31.8	40.0	39.4	31.0	31.0	32.0	44.0	55.0	52.0	45.6	42.0	43.6	69.2	78.0	78.0
29	39.0	33.0	25.3	.....	.....	.....	32.0	32.6	30.0	43.0	68.0	72.0	46.0	56.0	51.6	69.4	88.0	83.0
30	36.0	36.5	29.0	.....	.....	.....	39.6	39.0	37.0	48.0	60.0	54.0	44.0	49.0	49.0	73.6	86.0	83.5
31	37.0	29.0	23.0	.....	.....	.....	55.0	56.0	42.0	.....	.....	.....	47.0	50.0	52.8	.....	.....	.....
Av.	37.3	32.5	30.1	17.9	34.5	21.2	40.3	41.1	32.0	42.7	50.4	47.5	52.4	61.9	60.3	60.5	75.1	71.4

## STANDARD AIR THERMOMETER.

JULY.			AUGUST.			SEPTEMBER.			OCTOBER.			NOVEMBER.			DECEMBER.		
7 A. M.	12 M.	6 P. M.	7 A. M.	12 M.	6 P. M.	7 A. M.	12 M.	6 P. M.	7 A. M.	12 M.	6 P. M.	7 A. M.	12 M.	6 P. M.	7 A. M.	12 M.	6 P. M.
74.0	82.0	84.3	62.0	77.0	75.0	56.0	76.5	78.0	50.5	64.0	58.0	44.0	48.5	45.0	34.0	36.0	34.5
74.5	82.0	87.0	60.0	68.0	73.0	64.5	84.0	74.0	50.0	66.0	59.5	37.0	58.0	59.0	33.0	33.5	34.0
68.0	83.5	80.7	68.5	74.0	65.0	61.5	79.5	81.0	61.5	74.0	63.0	54.0	49.0	46.0	28.0	32.0	30.0
68.0	78.0	68.0	58.5	69.0	66.0	66.0	83.0	80.0	56.0	69.0	63.0	42.5	49.0	45.0	28.0	33.5	33.0
60.0	72.0	70.0	59.5	78.0	73.8	70.0	80.5	87.5	49.0	57.0	51.0	43.0	39.0	36.0	35.0	37.0	36.5
60.0	80.0	73.5	62.0	81.0	73.0	61.0	79.0	71.5	50.0	54.0	52.0	33.0	35.0	32.5	35.0	42.0	34.0
60.0	64.0	60.0	67.3	88.5	83.0	63.0	75.0	74.0	45.0	59.5	55.0	30.0	36.0	32.0	30.0	40.5	39.5
56.0	66.0	60.3	67.0	85.0	72.5	70.0	73.5	71.0	58.0	63.0	54.0	27.5	29.5	29.0	39.0	40.5	42.0
59.0	72.0	71.0	63.0	60.0	64.5	69.0	81.0	73.0	41.0	46.5	46.0	28.0	33.0	32.0	39.0	39.3	38.7
61.0	80.0	74.3	58.3	70.0	61.0	69.0	69.0	63.0	43.0	47.0	42.0	32.0	37.0	33.0	31.0	35.0	36.0
65.0	85.0	77.0	56.0	71.5	72.0	54.5	62.0	59.5	46.0	47.5	43.5	27.0	31.0	26.0	35.0	39.0	39.0
70.3	88.5	86.0	65.0	66.5	66.5	50.0	65.5	61.5	42.5	59.0	43.0	24.0	24.0	31.0	42.0	47.0	44.0
80.0	91.0	72.0	62.0	73.5	74.0	55.0	66.0	61.0	40.0	57.2	45.0	23.0	34.0	35.0	37.0	38.0	37.0
63.0	79.0	75.3	63.0	82.0	78.0	61.0	73.0	71.0	40.0	37.0	35.0	35.0	35.5	35.0	35.0	40.0	37.0
66.0	81.0	69.5	68.0	73.0	64.5	63.0	77.5	80.0	35.0	42.0	43.0	35.0	43.0	47.0	37.0	51.0	46.0
65.0	81.0	78.5	65.0	70.0	63.0	67.5	66.0	65.0	40.0	54.0	60.0	44.0	57.0	49.0	41.5	48.0	55.3
67.3	88.0	84.5	67.5	78.0	65.0	53.0	73.0	63.0	52.0	57.0	50.0	36.0	38.0	31.0	40.0	38.3	36.0
73.0	93.0	88.0	54.0	63.5	60.5	53.5	71.0	65.0	42.0	54.0	47.0	23.0	39.0	37.5	27.0	30.5	27.0
72.0	93.0	86.0	60.0	72.0	71.0	61.0	62.5	61.0	41.5	64.0	52.0	23.0	23.5	17.0	31.0	39.0	37.0
71.0	95.0	76.3	67.0	80.0	78.0	60.0	68.5	62.0	52.0	68.0	63.0	17.0	27.5	33.0	29.0	43.0	38.0
65.0	63.0	63.0	64.0	73.5	66.0	55.0	78.0	71.0	50.0	71.0	65.0	35.0	49.0	42.0	30.3	44.3	46.3
60.0	74.0	73.0	55.0	76.0	75.0	61.0	79.0	69.0	55.0	64.0	57.0	33.5	45.0	43.0	40.5	34.0	25.5
65.2	80.0	76.0	69.0	86.0	82.0	66.0	77.0	67.0	54.0	61.5	56.0	47.0	51.5	40.0	14.5	24.0	14.0
60.0	72.0	70.0	66.5	91.0	87.0	53.0	58.0	57.0	52.0	51.5	52.0	35.0	40.0	35.0	22.0	34.0	34.3
66.5	79.5	81.0	67.0	90.0	75.0	45.0	52.0	45.0	47.0	57.0	50.0	31.0	31.0	31.0	37.0	33.0	34.0
68.0	80.5	79.0	61.0	72.0	63.5	34.0	52.0	56.0	42.0	54.0	52.0	22.5	29.0	30.0	20.0	30.0	18.5
71.5	92.0	88.0	51.0	73.0	76.0	53.0	66.0	60.0	45.0	62.5	54.0	40.0	45.5	35.0	13.0	10.0	7.0
75.0	92.0	87.0	64.0	73.0	65.0	53.0	73.0	67.5	42.0	62.5	56.0	20.0	23.0	23.5	5.0	11.0	4.0
78.0	85.3	78.0	51.0	71.0	62.0	67.0	77.0	71.0	44.0	65.0	58.0	14.0	21.0	18.5	5.5	15.0	11.3
70.0	85.3	83.0	60.0	61.0	64.0	58.0	75.0	71.0	54.0	59.0	56.5	27.0	28.3	30.0	16.5	26.0	30.0
62.0	74.0	69.0	59.0	72.0	60.0	.....	.....	.....	42.0	48.5	46.5	.....	.....	.....	19.0	21.5	11.0
67.1	81.6	76.4	60.6	74.9	70.1	58.7	71.8	67.2	47.0	58.0	52.6	32.3	33.1	35.3	29.1	33.9	31.3

## READING OF SOIL THERMOMETERS.

1894.																	
ONE INCH.			TWO INCHES.			THREE INCHES.			SIX INCHES.			NINE INCHES.			EIGHTEEN INCHES.		
7 A.M.	13 M.	6 P.M.	7 A.M.	12 M.	6 P.M.	7 A.M.	12 M.	6 P.M.	7 A.M.	12 M.	6 P.M.	7 A.M.	12 M.	6 P.M.	7 A.M.	12 M.	6 P.M.
51.0	59.6	68.0	51.3	59.0	64.5	50.7	57.6	61.3	51.6	54.0	57.5	51.0	51.4	53.6	54.7	55.0	56.3
57.2	64.2	61.2	57.0	61.4	61.2	56.7	60.7	60.4	56.6	57.4	58.5	54.0	54.4	55.5	56.7	56.8	57.0
54.5	60.3	58.5	53.5	59.8	58.4	54.2	58.3	60.8	55.0	56.4	58.7	54.5	54.2	55.5	57.5	57.4	58.0
56.5	66.6	58.5	55.5	56.7	58.4	54.0	55.7	57.5	56.5	56.8	56.4	54.5	54.3	54.5	56.0	55.0	57.0
60.8	68.4	61.0	57.7	60.5	60.6	56.6	59.4	59.4	58.5	54.5	57.4	53.0	53.0	54.5	57.4	57.5	57.9
61.3	61.8	60.7	60.8	61.0	60.6	58.6	59.3	59.0	58.2	56.8	56.0	54.3	54.5	54.3	57.4	56.3	57.0
58.5	58.5	58.2	58.6	58.3	58.6	57.6	58.2	58.6	58.6	57.0	57.7	54.3	55.5	55.0	56.0	56.0	58.0
57.2	57.2	57.2	58.6	57.0	57.6	58.2	57.8	57.3	56.0	55.6	57.0	53.8	53.7	54.8	56.0	56.6	58.0
56.5	56.5	56.4	56.4	56.4	56.4	56.4	56.3	56.3	56.0	55.0	55.0	53.8	53.8	53.8	54.8	54.8	56.0
57.8	57.8	57.8	57.0	57.0	56.2	56.2	56.4	56.8	56.8	55.0	55.2	54.0	54.0	55.0	56.0	56.3	58.0
54.5	58.8	59.0	56.0	57.6	59.0	54.5	56.8	56.8	55.0	56.5	57.2	54.0	54.0	55.0	56.0	56.3	58.4
58.5	58.5	58.5	58.0	58.0	58.0	51.2	57.0	59.7	53.2	57.6	57.6	54.5	54.5	55.0	56.3	56.3	58.6
51.8	58.6	63.6	51.4	61.3	62.6	51.3	59.4	59.7	56.6	54.4	55.5	56.0	56.0	56.0	58.3	58.3	58.6
57.4	57.4	59.8	52.6	57.0	56.3	52.5	56.2	56.6	56.6	54.4	55.5	56.0	56.0	56.0	58.3	58.3	58.6
58.5	59.0	59.8	49.3	58.0	59.3	49.0	57.0	59.4	51.6	54.2	56.3	53.0	53.2	54.8	54.8	56.0	59.0
48.2	59.8	59.3	58.5	58.6	58.6	58.6	58.0	57.0	57.6	54.5	56.2	54.6	54.6	54.8	58.3	58.3	58.3
53.8	60.0	64.0	54.0	58.5	63.0	53.5	56.8	61.5	54.4	55.2	59.0	54.0	54.0	55.7	58.0	58.0	58.7
60.4	60.0	63.4	60.0	63.0	63.0	59.2	61.6	62.3	58.6	60.6	61.2	56.7	56.7	59.0	59.7	60.5	60.5
57.0	57.0	56.0	57.2	57.0	56.2	57.0	56.5	56.0	58.0	57.3	58.0	56.7	56.7	57.0	57.0	61.0	61.0
56.2	57.4	59.0	55.6	57.0	59.0	56.8	57.9	58.0	58.0	57.3	58.0	57.0	57.0	57.0	60.7	60.0	60.0
54.0	54.0	56.0	54.2	54.0	55.5	54.0	53.0	55.0	56.6	54.2	55.0	54.3	54.3	54.3	60.0	58.8	58.8
54.0	57.4	53.5	53.5	57.2	57.0	52.6	56.0	56.0	56.0	54.0	55.0	54.0	54.0	54.5	59.0	58.0	58.0
58.7	56.0	59.5	54.0	56.2	56.6	53.6	56.6	56.5	53.6	56.0	56.0	54.6	54.6	54.6	59.0	59.0	59.0
58.5	58.5	58.4	56.5	58.4	58.4	56.5	58.4	57.4	53.5	56.2	56.8	54.5	54.5	54.5	59.0	59.0	59.0
63.7	64.2	62.3	64.0	62.3	64.4	63.5	61.0	63.3	61.0	57.5	61.3	54.5	54.5	56.7	59.0	59.0	59.6
57.8	57.8	57.8	56.5	56.5	56.5	56.5	56.5	56.5	56.5	56.5	56.5	56.5	56.5	56.5	59.8	60.6	61.0
57.0	57.0	57.0	56.4	56.4	56.4	56.4	56.4	56.4	56.4	56.4	56.4	56.4	56.4	56.4	59.8	60.6	61.0
56.5	56.5	56.5	56.5	56.5	56.5	56.5	56.5	56.5	56.5	56.5	56.5	56.5	56.5	56.5	59.8	59.8	59.8
49.0	54.5	57.2	49.2	56.7	57.0	48.6	55.4	54.4	59.0	54.0	56.4	53.5	53.5	55.0	60.8	59.8	59.6
51.0	58.5	57.2	51.7	56.7	56.0	48.6	55.4	55.6	51.8	54.0	56.4	53.5	53.5	55.0	60.8	59.8	59.6
53.0	53.0	54.3	51.7	56.7	56.0	51.3	53.6	53.6	53.6	53.6	53.6	53.6	53.6	54.0	54.6	54.6	56.7
53.0	54.0	56.0	54.4	56.3	56.8	52.0	53.2	55.3	53.0	53.4	53.4	53.7	54.0	54.0	59.0	56.3	56.7
Average.....	58.7	59.3	54.0	58.1	59.0	53.6	58.7	58.1	54.6	58.8	57.1	54.3	54.5	55.1	58.7	58.7	58.8

## READING OF SOIL THERMOMETERS — (Continued).

1894.		ONE INCH.			TWO INCHES.			THREE INCHES.			SIX INCHES.			NINE INCHES.			EIGHTEEN INCHES.		
		7 A.M.			7 A.M.			7 A.M.			7 A.M.			7 A.M.			7 A.M.		
		13 M.	6 P.M.		13 M.	6 P.M.		13 M.	6 P.M.		13 M.	6 P.M.		13 M.	6 P.M.		13 M.	6 P.M.	
June	1.....	51.7	55.5	56.0	53.0	55.0	55.5	51.6	54.5	55.3	54.0	55.0	55.5	53.4	53.3	54.3	53.7	53.7	53.7
2.....	51.0	52.0	54.6	54.6	51.0	52.0	54.6	50.6	53.5	53.5	52.5	53.5	53.5	53.5	53.5	54.3	53.7	53.7	53.7
3.....	51.0	52.0	54.6	54.6	51.0	52.0	54.6	50.6	53.5	53.5	52.5	53.5	53.5	53.5	53.5	54.3	53.7	53.7	53.7
4.....	51.0	52.0	54.6	54.6	51.0	52.0	54.6	50.6	53.5	53.5	52.5	53.5	53.5	53.5	53.5	54.3	53.7	53.7	53.7
5.....	51.0	52.0	54.6	54.6	51.0	52.0	54.6	50.6	53.5	53.5	52.5	53.5	53.5	53.5	53.5	54.3	53.7	53.7	53.7
6.....	51.0	52.0	54.6	54.6	51.0	52.0	54.6	50.6	53.5	53.5	52.5	53.5	53.5	53.5	53.5	54.3	53.7	53.7	53.7
7.....	51.0	52.0	54.6	54.6	51.0	52.0	54.6	50.6	53.5	53.5	52.5	53.5	53.5	53.5	53.5	54.3	53.7	53.7	53.7
8.....	51.0	52.0	54.6	54.6	51.0	52.0	54.6	50.6	53.5	53.5	52.5	53.5	53.5	53.5	53.5	54.3	53.7	53.7	53.7
9.....	51.0	52.0	54.6	54.6	51.0	52.0	54.6	50.6	53.5	53.5	52.5	53.5	53.5	53.5	53.5	54.3	53.7	53.7	53.7
10.....	51.0	52.0	54.6	54.6	51.0	52.0	54.6	50.6	53.5	53.5	52.5	53.5	53.5	53.5	53.5	54.3	53.7	53.7	53.7
11.....	51.0	52.0	54.6	54.6	51.0	52.0	54.6	50.6	53.5	53.5	52.5	53.5	53.5	53.5	53.5	54.3	53.7	53.7	53.7
12.....	51.0	52.0	54.6	54.6	51.0	52.0	54.6	50.6	53.5	53.5	52.5	53.5	53.5	53.5	53.5	54.3	53.7	53.7	53.7
13.....	51.0	52.0	54.6	54.6	51.0	52.0	54.6	50.6	53.5	53.5	52.5	53.5	53.5	53.5	53.5	54.3	53.7	53.7	53.7
14.....	51.0	52.0	54.6	54.6	51.0	52.0	54.6	50.6	53.5	53.5	52.5	53.5	53.5	53.5	53.5	54.3	53.7	53.7	53.7
15.....	51.0	52.0	54.6	54.6	51.0	52.0	54.6	50.6	53.5	53.5	52.5	53.5	53.5	53.5	53.5	54.3	53.7	53.7	53.7
16.....	51.0	52.0	54.6	54.6	51.0	52.0	54.6	50.6	53.5	53.5	52.5	53.5	53.5	53.5	53.5	54.3	53.7	53.7	53.7
17.....	51.0	52.0	54.6	54.6	51.0	52.0	54.6	50.6	53.5	53.5	52.5	53.5	53.5	53.5	53.5	54.3	53.7	53.7	53.7
18.....	51.0	52.0	54.6	54.6	51.0	52.0	54.6	50.6	53.5	53.5	52.5	53.5	53.5	53.5	53.5	54.3	53.7	53.7	53.7
19.....	51.0	52.0	54.6	54.6	51.0	52.0	54.6	50.6	53.5	53.5	52.5	53.5	53.5	53.5	53.5	54.3	53.7	53.7	53.7
20.....	51.0	52.0	54.6	54.6	51.0	52.0	54.6	50.6	53.5	53.5	52.5	53.5	53.5	53.5	53.5	54.3	53.7	53.7	53.7
21.....	51.0	52.0	54.6	54.6	51.0	52.0	54.6	50.6	53.5	53.5	52.5	53.5	53.5	53.5	53.5	54.3	53.7	53.7	53.7
22.....	51.0	52.0	54.6	54.6	51.0	52.0	54.6	50.6	53.5	53.5	52.5	53.5	53.5	53.5	53.5	54.3	53.7	53.7	53.7
23.....	51.0	52.0	54.6	54.6	51.0	52.0	54.6	50.6	53.5	53.5	52.5	53.5	53.5	53.5	53.5	54.3	53.7	53.7	53.7
24.....	51.0	52.0	54.6	54.6	51.0	52.0	54.6	50.6	53.5	53.5	52.5	53.5	53.5	53.5	53.5	54.3	53.7	53.7	53.7
25.....	51.0	52.0	54.6	54.6	51.0	52.0	54.6	50.6	53.5	53.5	52.5	53.5	53.5	53.5	53.5	54.3	53.7	53.7	53.7
26.....	51.0	52.0	54.6	54.6	51.0	52.0	54.6	50.6	53.5	53.5	52.5	53.5	53.5	53.5	53.5	54.3	53.7	53.7	53.7
27.....	51.0	52.0	54.6	54.6	51.0	52.0	54.6	50.6	53.5	53.5	52.5	53.5	53.5	53.5	53.5	54.3	53.7	53.7	53.7
28.....	51.0	52.0	54.6	54.6	51.0	52.0	54.6	50.6	53.5	53.5	52.5	53.5	53.5	53.5	53.5	54.3	53.7	53.7	53.7
29.....	51.0	52.0	54.6	54.6	51.0	52.0	54.6	50.6	53.5	53.5	52.5	53.5	53.5	53.5	53.5	54.3	53.7	53.7	53.7
30.....	51.0	52.0	54.6	54.6	51.0	52.0	54.6	50.6	53.5	53.5	52.5	53.5	53.5	53.5	53.5	54.3	53.7	53.7	53.7
Average.....	54.1	71.6	70.0	64.0	69.9	68.6	63.3	68.9	68.9	63.5	65.8	67.5	63.5	63.4	64.8	67.5	66.3	67.9	67.9

## READING OF SOIL THERMOMETERS — (Continued).

1894.	ONE INCH.			TWO INCHES.			THREE INCHES.			SIX INCHES.			NINE INCHES.			EIGHTEEN INCHES.		
	7 A.M.	12 M.	6 P.M.	7 A.M.	12 M.	6 P.M.	7 A.M.	12 M.	6 P.M.	7 A.M.	12 M.	6 P.M.	7 A.M.	12 M.	6 P.M.	7 A.M.	12 M.	6 P.M.
July 1.....	69.8	83.7	83.0	69.7	82.0	83.0	69.4	80.3	81.0	79.0	74.5	79.0	70.3	71.0	74.0	74.3	74.3	74.3
2.....	75.0	84.5	79.5	71.0	81.3	80.0	71.0	81.0	77.7	79.0	75.0	79.0	71.0	73.0	73.0	75.0	75.0	75.0
3.....	70.5	82.5	77.5	70.5	79.0	77.7	70.5	78.5	77.7	73.0	74.5	76.0	71.5	71.5	73.5	73.5	73.5	73.5
4.....	68.0	80.0	73.5	67.3	76.3	73.0	68.0	77.0	73.5	73.0	73.0	73.0	70.5	70.5	71.5	73.5	73.0	74.5
5.....	63.0	76.5	74.5	63.0	73.0	74.0	61.0	72.0	73.5	69.0	69.0	71.0	67.5	67.5	71.5	73.5	73.0	73.0
6.....	63.5	76.5	74.5	63.5	73.5	74.0	63.0	72.0	73.5	69.0	69.0	71.0	67.5	67.5	71.5	73.5	73.5	73.5
7.....	64.0	69.0	66.5	64.0	68.0	67.0	64.0	67.0	66.5	66.5	65.5	66.5	67.0	67.0	66.5	71.0	70.5	70.5
8.....	61.0	69.5	66.0	61.5	68.0	66.0	61.0	67.0	66.0	66.0	65.5	66.0	64.0	63.0	66.0	70.0	70.0	70.0
9.....	61.0	75.0	72.0	61.5	72.0	71.5	61.0	71.5	71.5	71.5	67.7	71.5	64.5	63.5	66.5	70.5	70.0	71.5
10.....	61.5	75.0	72.0	61.5	72.0	74.5	61.5	73.5	73.5	73.5	70.3	73.0	64.5	63.5	66.5	71.5	71.5	71.5
11.....	61.5	80.0	75.0	61.5	74.5	76.5	61.5	75.0	75.0	75.0	70.0	73.0	64.5	63.5	66.5	70.5	70.0	71.5
12.....	69.0	76.0	76.0	69.0	74.5	76.5	69.0	73.0	75.0	75.0	70.0	73.0	64.5	63.5	66.5	70.5	70.0	71.5
13.....	70.0	83.0	78.0	70.0	82.5	76.5	70.5	76.0	76.5	76.5	73.0	75.0	69.0	70.0	72.0	73.0	73.0	73.5
14.....	70.0	81.0	78.0	70.0	77.5	77.5	69.5	74.5	74.5	74.5	71.0	72.0	66.0	69.0	69.0	74.0	74.0	74.0
15.....	61.0	68.5	72.5	61.0	76.0	72.5	66.7	76.5	76.5	76.5	68.5	71.0	66.0	69.0	69.0	74.0	74.0	74.0
16.....	66.0	81.0	79.0	66.0	78.0	73.0	65.5	76.5	76.5	76.5	68.5	71.0	66.0	69.0	69.0	74.0	74.0	74.0
17.....	61.0	75.0	75.0	61.0	72.0	73.0	65.5	76.5	76.5	76.5	68.5	71.0	66.0	69.0	69.0	74.0	74.0	74.0
18.....	68.0	80.0	79.0	68.0	79.5	80.5	69.5	77.5	77.5	77.5	74.5	76.5	69.0	71.5	73.0	73.5	73.5	73.5
19.....	68.5	82.0	81.0	68.5	79.5	79.5	69.5	76.5	76.5	76.5	74.5	76.5	69.0	71.5	73.0	73.5	73.5	73.5
20.....	71.0	89.5	77.0	71.5	79.0	76.5	71.0	70.0	70.0	70.0	71.0	73.0	67.0	67.0	67.0	71.0	71.0	71.0
21.....	71.5	70.0	70.0	71.5	70.5	70.0	71.0	70.0	70.0	70.0	71.0	73.0	67.0	67.0	67.0	71.0	71.0	71.0
22.....	68.0	76.8	77.0	68.5	74.7	76.0	65.0	73.5	73.5	73.5	74.5	76.5	69.0	71.0	73.0	73.5	73.5	73.5
23.....	63.0	72.0	72.0	63.5	69.5	71.5	66.0	69.0	69.0	69.0	70.5	72.0	66.0	69.0	69.0	74.0	74.0	74.0
24.....	63.0	74.0	72.0	63.5	69.5	71.5	66.0	69.0	69.0	69.0	70.5	72.0	66.0	69.0	69.0	74.0	74.0	74.0
25.....	66.5	72.0	76.0	66.5	71.0	75.5	66.0	70.5	70.5	70.5	72.0	74.0	66.0	69.0	69.0	74.0	74.0	74.0
26.....	66.5	78.0	81.0	66.5	76.5	77.0	66.0	70.5	70.5	70.5	72.0	74.0	66.0	69.0	69.0	74.0	74.0	74.0
27.....	66.5	78.0	81.0	66.5	76.5	77.0	66.0	70.5	70.5	70.5	72.0	74.0	66.0	69.0	69.0	74.0	74.0	74.0
28.....	73.5	80.0	80.0	73.5	79.5	80.0	73.5	78.5	78.5	78.5	75.0	77.0	73.0	73.0	73.0	74.5	74.5	74.5
29.....	73.5	80.0	80.0	73.5	79.5	80.0	73.5	78.5	78.5	78.5	75.0	77.0	73.0	73.0	73.0	74.5	74.5	74.5
30.....	70.0	76.0	76.0	70.0	73.5	73.5	70.0	73.5	73.5	73.5	74.5	76.5	73.0	73.0	73.0	74.5	74.5	74.5
31.....	70.0	74.5	75.0	70.0	73.5	74.5	70.0	73.5	73.5	73.5	74.5	76.5	73.0	73.0	73.0	74.5	74.5	74.5
Average.....	67.2	76.9	75.6	68.1	75.3	75.1	68.1	74.3	74.3	73.1	71.1	73.1	69.6	69.1	71.0	73.6	73.6	73.6

READING OF SOIL THERMOMETERS — (Continued).

	ONE INCH.			TWO INCHES.			THREE INCHES.			SIX INCHES.			NINE INCHES.			EIGHTEEN INCHES.		
	7 A.M.	12 M.	6 P.M.	7 A.M.	12 M.	6 P.M.	7 A.M.	12 M.	6 P.M.	7 A.M.	12 M.	6 P.M.	7 A.M.	12 M.	6 P.M.	7 A.M.	12 M.	6 P.M.
	1894.																	
August 1 .....	65.5	73.0	73.0	67.0	72.0	72.5	66.0	71.0	72.0	63.5	70.0	72.0	69.0	70.5	70.5	70.5	76.0	76.0
2 .....	67.5	69.5	71.0	68.0	69.5	71.0	67.5	69.0	70.0	69.0	69.0	70.0	69.5	69.0	69.0	74.5	74.0	74.0
3 .....	68.5	73.0	71.5	69.5	73.0	71.0	68.0	71.5	71.0	69.0	70.5	70.5	69.0	69.0	69.5	74.0	74.5	73.0
4 .....	74.0	69.5	70.0	61.5	69.0	70.0	64.0	68.5	69.0	67.0	68.5	69.5	69.0	67.5	68.5	74.0	73.5	73.0
5 .....	62.5	70.0	72.7	63.0	66.5	72.0	63.0	68.5	73.0	63.5	67.5	68.0	67.0	67.0	67.0	73.0	73.0	73.5
6 .....	64.0	71.0	72.5	64.5	70.5	72.5	64.5	69.0	70.5	63.5	67.5	68.0	67.0	67.0	68.5	73.0	73.5	73.5
7 .....	66.5	72.0	74.0	66.5	71.5	73.5	66.5	74.5	72.5	67.5	69.0	71.5	68.0	68.0	69.5	73.0	73.0	73.0
8 .....	67.5	71.5	71.0	67.5	71.0	71.0	67.0	70.0	70.5	68.5	68.0	70.0	68.5	68.0	69.0	73.0	73.5	73.5
9 .....	68.0	69.5	69.0	68.0	67.5	68.0	67.5	67.5	67.5	68.5	68.0	68.5	68.5	68.0	68.0	73.0	73.5	73.5
10 .....	68.5	69.0	70.0	68.0	68.5	69.5	68.0	67.5	68.5	64.0	67.0	68.5	68.5	68.0	67.0	73.0	73.0	74.0
11 .....	60.0	69.0	70.5	61.0	68.5	69.5	61.0	67.0	68.5	64.0	66.0	66.0	66.0	66.0	67.0	72.0	72.0	71.0
12 .....	64.5	65.0	66.0	64.5	66.0	66.0	64.0	64.5	65.5	63.5	66.5	66.0	65.5	66.0	66.0	71.0	71.0	71.5
13 .....	68.0	70.5	64.0	63.0	70.5	73.0	63.0	69.0	71.0	64.0	67.0	68.5	67.0	64.5	66.5	70.5	71.0	71.5
14 .....	61.0	74.5	72.5	64.0	72.5	72.0	64.0	71.0	71.0	60.0	68.5	69.5	69.0	67.5	69.0	71.5	71.5	71.5
15 .....	68.0	74.0	71.0	67.0	73.0	71.0	66.5	71.5	70.5	67.5	69.5	71.0	67.5	69.0	69.0	72.0	72.0	72.0
16 .....	63.0	72.5	70.0	62.0	71.5	70.0	60.5	71.0	70.0	67.0	69.5	69.5	69.0	69.0	69.0	71.5	72.0	72.0
17 .....	63.0	73.0	72.0	61.0	72.0	71.5	61.5	71.0	70.5	64.0	72.5	71.0	64.0	69.5	68.0	71.5	72.0	72.0
18 .....	61.0	70.0	69.5	63.0	69.5	69.0	63.0	70.0	69.0	64.0	69.5	70.5	65.0	68.0	67.0	72.0	72.0	71.5
19 .....	64.0	74.0	72.0	63.0	69.5	71.5	64.0	73.0	71.0	64.0	69.5	66.0	66.0	66.0	67.0	72.0	72.0	73.0
20 .....	63.0	68.5	67.0	63.0	69.5	69.5	63.0	67.5	69.0	63.0	67.0	66.0	65.0	66.0	66.0	72.0	72.0	73.0
21 .....	61.0	70.0	72.0	61.0	71.5	73.5	61.0	69.0	72.5	64.0	67.0	72.5	66.0	66.0	68.5	72.0	72.0	73.0
22 .....	60.5	72.0	64.0	61.0	61.0	73.0	61.0	69.0	72.5	64.0	67.0	72.5	66.0	66.0	68.5	72.0	72.0	73.0
23 .....	62.5	73.0	69.5	63.0	74.5	74.5	63.0	71.0	73.5	63.0	68.5	68.5	66.0	66.0	68.5	72.0	72.0	73.0
24 .....	66.5	73.0	77.0	66.5	77.0	73.5	67.5	74.0	74.0	66.0	70.5	73.0	69.0	68.5	68.5	73.0	73.5	74.0
25 .....	67.5	73.0	77.5	67.0	73.5	73.5	67.5	75.5	73.5	69.0	71.5	74.5	69.0	68.5	68.5	73.0	73.5	73.5
26 .....	66.5	73.0	74.0	67.0	74.0	74.0	66.5	74.0	73.5	63.0	67.0	73.5	69.0	68.5	68.5	73.0	73.5	73.5
27 .....	69.5	70.0	73.0	69.5	70.0	72.5	69.5	69.5	71.5	64.1	67.0	70.5	64.5	67.0	68.5	73.0	73.5	73.5
28 .....	66.0	73.0	73.5	66.0	74.0	72.5	66.0	72.0	72.0	67.0	67.0	66.5	67.0	66.0	66.0	72.0	72.0	73.0
29 .....	69.0	71.5	71.5	69.0	71.5	70.0	61.0	69.5	69.5	64.5	67.0	69.5	64.0	65.0	65.0	71.0	71.0	71.0
30 .....	62.5	64.0	66.0	63.0	64.0	66.0	61.0	63.5	63.5	63.0	64.5	63.0	64.0	64.5	64.5	70.5	70.5	70.5
31 .....	61.0	70.0	69.5	61.5	69.5	69.5	61.0	68.0	68.5	63.0	66.0	66.0	64.0	64.5	67.0	70.5	70.5	70.5
Average .....	64.1	71.6	63.5	64.1	71.1	70.9	64.3	69.9	70.6	65.3	68.3	70.0	66.5	67.5	68.2	72.4	72.4	73.3

## READING OF SOIL THERMOMETERS — (Continued).

1894.	ONE INCH.			TWO INCHES.			THREE INCHES.			SIX INCHES.			NINE INCHES.			EIGHTEEN INCHES.		
	7 A. M.	12 M.	6 P. M.	7 A. M.	12 M.	6 P. M.	7 A. M.	12 M.	6 P. M.	7 A. M.	12 M.	6 P. M.	7 A. M.	12 M.	6 P. M.	7 A. M.	12 M.	6 P. M.
	60.0	69.0	69.0	60.0	69.0	69.0	60.0	69.0	69.0	63.0	65.0	68.0	64.0	64.0	66.0	70.5	70.5	70.0
September 1	62.0	72.5	73.5	62.0	72.5	73.5	62.0	72.5	73.5	68.5	72.5	73.5	64.0	65.0	67.5	70.5	70.5	70.5
2	61.0	71.5	73.5	61.0	71.5	73.5	61.0	71.5	73.5	68.5	72.5	73.5	64.0	65.0	67.5	70.5	70.5	71.0
3	61.0	71.5	73.5	61.0	71.5	73.5	61.0	71.5	73.5	68.5	72.5	73.5	64.0	65.0	67.5	70.5	70.5	71.0
4	61.0	71.5	73.5	61.0	71.5	73.5	61.0	71.5	73.5	68.5	72.5	73.5	64.0	65.0	67.5	70.5	70.5	71.0
5	61.0	71.5	73.5	61.0	71.5	73.5	61.0	71.5	73.5	68.5	72.5	73.5	64.0	65.0	67.5	70.5	70.5	71.0
6	61.0	71.5	73.5	61.0	71.5	73.5	61.0	71.5	73.5	68.5	72.5	73.5	64.0	65.0	67.5	70.5	70.5	71.0
7	61.0	71.5	73.5	61.0	71.5	73.5	61.0	71.5	73.5	68.5	72.5	73.5	64.0	65.0	67.5	70.5	70.5	71.0
8	61.0	71.5	73.5	61.0	71.5	73.5	61.0	71.5	73.5	68.5	72.5	73.5	64.0	65.0	67.5	70.5	70.5	71.0
9	61.0	71.5	73.5	61.0	71.5	73.5	61.0	71.5	73.5	68.5	72.5	73.5	64.0	65.0	67.5	70.5	70.5	71.0
10	61.0	71.5	73.5	61.0	71.5	73.5	61.0	71.5	73.5	68.5	72.5	73.5	64.0	65.0	67.5	70.5	70.5	71.0
11	61.0	71.5	73.5	61.0	71.5	73.5	61.0	71.5	73.5	68.5	72.5	73.5	64.0	65.0	67.5	70.5	70.5	71.0
12	61.0	71.5	73.5	61.0	71.5	73.5	61.0	71.5	73.5	68.5	72.5	73.5	64.0	65.0	67.5	70.5	70.5	71.0
13	61.0	71.5	73.5	61.0	71.5	73.5	61.0	71.5	73.5	68.5	72.5	73.5	64.0	65.0	67.5	70.5	70.5	71.0
14	61.0	71.5	73.5	61.0	71.5	73.5	61.0	71.5	73.5	68.5	72.5	73.5	64.0	65.0	67.5	70.5	70.5	71.0
15	61.0	71.5	73.5	61.0	71.5	73.5	61.0	71.5	73.5	68.5	72.5	73.5	64.0	65.0	67.5	70.5	70.5	71.0
16	61.0	71.5	73.5	61.0	71.5	73.5	61.0	71.5	73.5	68.5	72.5	73.5	64.0	65.0	67.5	70.5	70.5	71.0
17	61.0	71.5	73.5	61.0	71.5	73.5	61.0	71.5	73.5	68.5	72.5	73.5	64.0	65.0	67.5	70.5	70.5	71.0
18	61.0	71.5	73.5	61.0	71.5	73.5	61.0	71.5	73.5	68.5	72.5	73.5	64.0	65.0	67.5	70.5	70.5	71.0
19	61.0	71.5	73.5	61.0	71.5	73.5	61.0	71.5	73.5	68.5	72.5	73.5	64.0	65.0	67.5	70.5	70.5	71.0
20	61.0	71.5	73.5	61.0	71.5	73.5	61.0	71.5	73.5	68.5	72.5	73.5	64.0	65.0	67.5	70.5	70.5	71.0
21	61.0	71.5	73.5	61.0	71.5	73.5	61.0	71.5	73.5	68.5	72.5	73.5	64.0	65.0	67.5	70.5	70.5	71.0
22	61.0	71.5	73.5	61.0	71.5	73.5	61.0	71.5	73.5	68.5	72.5	73.5	64.0	65.0	67.5	70.5	70.5	71.0
23	61.0	71.5	73.5	61.0	71.5	73.5	61.0	71.5	73.5	68.5	72.5	73.5	64.0	65.0	67.5	70.5	70.5	71.0
24	61.0	71.5	73.5	61.0	71.5	73.5	61.0	71.5	73.5	68.5	72.5	73.5	64.0	65.0	67.5	70.5	70.5	71.0
25	61.0	71.5	73.5	61.0	71.5	73.5	61.0	71.5	73.5	68.5	72.5	73.5	64.0	65.0	67.5	70.5	70.5	71.0
26	61.0	71.5	73.5	61.0	71.5	73.5	61.0	71.5	73.5	68.5	72.5	73.5	64.0	65.0	67.5	70.5	70.5	71.0
27	61.0	71.5	73.5	61.0	71.5	73.5	61.0	71.5	73.5	68.5	72.5	73.5	64.0	65.0	67.5	70.5	70.5	71.0
28	61.0	71.5	73.5	61.0	71.5	73.5	61.0	71.5	73.5	68.5	72.5	73.5	64.0	65.0	67.5	70.5	70.5	71.0
29	61.0	71.5	73.5	61.0	71.5	73.5	61.0	71.5	73.5	68.5	72.5	73.5	64.0	65.0	67.5	70.5	70.5	71.0
30	61.0	71.5	73.5	61.0	71.5	73.5	61.0	71.5	73.5	68.5	72.5	73.5	64.0	65.0	67.5	70.5	70.5	71.0
Average	61.3	67.9	67.5	61.7	67.9	68.1	62.0	66.3	66.7	63.1	64.8	66.5	63.7	64.6	64.8	69.5	69.7	69.3





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